The Gorgan Plain of northeast Iran: a diachronic analysis of settlement and land use patterns relating to urban, rural and mobile populations on a Sasanian frontier

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Abstract

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The Gorgan Plain of northeast Iran was one of the northern frontiers of the Sasanian Empire (c. AD 225-640), and was marked by considerable investment in water management and defensive features such as canals, fortifications and the nearly 200 km long-wall known as the Gorgan Wall. However, in comparison we know very little about settlement and land use associated with urban, rural, and mobile pastoral communities in this period. What impact did Sasanian investment in this landscape have on settlement patterns, networks of movement, and subsistence economies of the communities inhabiting the plain, and how do these developments fit within the long-term settlement history of the region? This thesis reconstructs Late Iron Age through Islamic settlement and land use patterns utilising data obtained from historical (CORONA) satellite imagery, integrated with the available settlement data draw from field surveys conducted by the *Gorgan Wall* project, other published surveys, and historical and ethnographic information. At the local and regional scale, the observed trends are discussed in terms of changes in site type and location, subsistence strategies and agricultural investment. These trends are then compared to landscape developments associated with the later territorial empires in other regions of the Near East.

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1 INTRODUCTION

1.1 THE SETTING

The Gorgan Plain, located in the province of Golestan in Iran, is an archaeologically rich area as evidenced by the hundreds of archaeological sites dotting the region dating from Palaeolithic to more recent times. Geographically, the plain extends from the foothills of the Alborz Mountains northwards into the steppes of southwest Turkmenistan, and is crossed by two large river systems, the Gorgan and the Atrak[1] (Fig. 1-1). As the plain covers such a vast area, it is therefore not surprising that it encompasses multiple environmental zones distinguished by high rainfall near the foothills of the Alborz range, and increasing aridity as one moves north. Marking the shift from the rain-fed agricultural zone to the drier steppe is the Gorgan River, which dissects the plain from east to west. The long-term settlement history of the region is closely linked to the exploitation of these distinct environmental zones, with numerous cities, town and villages, and maximum investment in agriculture in the area between the Alborz foothills and the Gorgan River, and diminishing permanent settlement and focus on pastoral exploitation north of the Gorgan River.

Recent archaeological research has highlighted the vast military investments that were made in the region during the period of the Sasanian Empire (3rd – 7th century AD) (Nokandeh et al. 2006; Omrani Rekavandi et al. 2007; Omrani Rekavandi et al. 2008; Sauer et al. 2013). Less focus, however, has been placed on contextualising these developments within the broader Sasanian period settlement pattern, or, importantly, within the framework of developments in the preceding and succeeding periods as understood from regional survey data. This thesis, therefore, aims to reconstruct Late Iron Age through Early Islamic period settlement and land use patterns on the Gorgan Plain, building on the work of Wilkinson et al. (2013), through the integration of data from the remote sensing of historical and modern satellite imagery, archaeological survey, ethnographic studies and historical accounts.

[1] For the purpose of this study, the Gorgan Plain, will be used to denote the region between the Alborz Mountains and the Atrak River (which also forms the modern border between Iran and Turkmenistan). In this context, the Gorgan Plain extends over an area of nearly 10,000 km^2.

To set the stage for this analysis, a brief overview of the textual sources relating to historical developments in the area for the period under consideration will be undertaken. As part of the region known as Verkhana or Hyrcania[2], the plain features in numerous historical accounts from at least the 6th century BC through to the Islamic period, mainly in the context of its relationship to successive foreign polities and territorial empires. As such, it seems important to consider the relationship between the historical and archaeological data. Following on from this, I will review the archaeological investigations that have been carried out in the region to date, discuss how this research has informed the current study, and set out the specific research questions that will be addressed in this thesis.

1.2 TEXTUAL SOURCES RELATING TO THE HISTORY OF THE GORGAN PLAIN FROM C. 800 BC TO THE 13TH/14TH CENTURY AD

The political history of the Medians, and the Achaemenid, Parthian and Sasanian empires, as viewed through roughly contemporary textual sources, is complex and incomplete (Brunner 1983; Wiesehöfer 2001). In some cases, Arab and Persian historians and geographers of the Middle Ages, who give us contemporary accounts of the region, also provide us with textual material regarding these earlier periods (e.g. al Tabari), but while useful, these second hand accounts are filtered by time, space and culture. A thorough review of both late antique and medieval sources has been treated in detail elsewhere, and it is unnecessary to repeat those efforts here (see Daryaee 2012; Widengren 2007 p.1261–1283; Wiesehöfer 2001).

As will be demonstrated, the history of the Gorgan Plain is really a side note in the story of successive powerful empires. However, a small selection of the sources that deal directly with events in, and descriptions of, the geography, settlement, and land-use of northeast Iran between roughly the 7th century BC and AD to the Early Islamic Period is summarised below.

[2] Hyrcania is the historical name for a large portion of the modern provinces of Gilan, Manzanderan, and Golestan, in Iran – generally thought to be the western and southern regions bordering the Caspian Sea

1.2.1 THE MEDES (C. LATE 7TH CENTURY BC TO 550 BC)

In the first quarter of the 1st millennium BC, the Medes emerge as a loose confederation of polities in western Iran, mentioned in Assyrian sources. They appear often to have been the target of Assyrian expansionist kings who campaigned into the Central Zagros. This may have been the mechanism that caused the formation of a more formal Median confederacy by the mid-7th century BC (Abdi 2011 p.33), however it is unlikely that they should be considered an 'empire'; a point that has been argued by Sancisi-Weerdenburg (1988). By this time, most of northwestern Iran was considered to be part of Media, however, its exact geographical extent is open to debate. Little is known as to where the northern and eastern boundaries of the Median state extended to at this time. It is likely that it stretched to the Dasht-e Kavir desert on the Iranian plateau in the east and potentially as far northeast as Mount Damavand (Dandamaev and Medvedskaya 1996).

Unfortunately, there are no Median written records. Assyrian texts, such as the Chronicle of Nabopolassar, however, give us the details of conflicts between these two groups, and eventual loss of Assyrian territory to a coalition of Medes and Babylonians in c. 614 BC (Abdi 2011 p.34; Dandamaev and Medvedskaya 1996; Wiesehöfer 2001 p.1). Following on from these events, the Median king Cyaxares is said to have tried to expand his empire to regions east and south of the Caspian Sea, namely Parthia and Hyrcania[3] (Dandamaev and Medvedskaya 1996). Herodotus (1.95-107, trans. Godley 1920), writing in the mid-5th century BC also provides an account of the Median rulers, and the expansion of territory under them, but makes no specific mention of Hyrcania in this context. Circumstantial evidence for Median influence in northeast Iran has been drawn out of later references, such as Strabo (XI, 7,2 trans. Strabo 1917). Writing around the late 1st century BC, he states that before the Parthians and Persians, the Medes held sway in the region. Furthermore, the Behistun inscription indicates that the inhabitants of Parthia and Hyrcania rose up against Darius and pledged allegiance to a Median chieftain, suggesting a historical tie to Media (Dandamaev and Lukonin 1989 p.60–61; Vogelsang 1992 p.192). While some scholars have linked archaeological finds in the Gorgan region with a Median presence (see Deshayes 1969; Deshayes 1979; Vogelsang 1992 p.297), there is little material evidence to date to substantiate a claim of an identifiable Median presence in or control of the region.

[3] Parthia is a historical geographical area taking in parts of what is now northeast Iran (Khorasan) and Southern Turkmenistan (including the Kopet Dagh). See also footnote 2.

1.2.2 THE ACHAEMENID EMPIRE (C. 550 – 330 BC)

In the mid-6th century BC the Achaemenid dynasty rose to power forming the first unequivocal Persian territorial empire. There are limited primary accounts of the period by the Persians themselves, though a number of royal proclamations in various contemporary scripts, such as the Behistun inscription, and some administrative documents, most notably the Persepolis fortification tablets, have been found (see Briant et al. 2008; Hallock 1969, Kent 1953). There are also a number of Greek and Roman sources providing a roughly contemporary (e.g. Herodotus, Ctesias, Xenophon,) and later (e.g. Arrian, Quintus Curtius and Strabo), though 'outsider', view of the Persian Empire, and finally, religious and astronomical texts (i.e. the Bible) give some accounts of the Persian Empire (Schmidtt 1983; Shapour Shahbazi 2012 p.121).

The Achaemenid dynasty originating from southern Iran near Persepolis, is said to have incorporated, along with large swathes of territory in western Iran, Anatolia and Mesopotamia, eastern Iran and Central Asia (Wiesehöfer 2001 p.57). Parthia and Hyrcania were likely added to the Achaemenid Empire during Cyrus's eastern campaign sometime between 550 and 540 BC (Dandamaev and Lukonin 1989 p.90; Shapour Shahbazi 2012 p.123).

Hyrcania is mentioned in the Behistun inscription, a trilingual relief cut into a rock face near the ancient Median capital of Ecbatana, in relation to the revolts put down during the first years of the reign of Darius (c. 522-519 BC) by his father Hystaspes (Schmidtt 2013).

> Saith Darius the King: Parthia and Hyrcania became rebellious from me, called themselves (adherents) of Phraortes. Hystaspes my father – he was in Parthia; him the people abandoned, became rebellious. Thereupon Hystaspes went forth with the army which was faithful to him. A town by name Vishpauzati, in Parthia – there he joined battle with the Parthians. Ahuramazda bore me aid; by the favor of Ahuramazda Hystaspes smote that rebellious army exceedingly; of the month Viyakhna XXII days were past – then the battle was fought by them. (Behistun Inscription, Old Persian, column III trans. Kent 1953 p. 124)

The above quote from the Behistun inscription demonstrates the close relationship between 'Hyrcania' and 'Parthia' as geographical designators for what is now north east Iran and parts of central Asia. Dandamaev and Lukonin (1989 p.98–99) see this as a result of the often changing administrative boundaries in which Hyrcania was often considered within Parthia.

1.2.3 ALEXANDER AND THE SELEUCIDS (330 - C. 247 BC)

The fall of the Achaemenid dynasty came with the victories of Alexander the Great between 334 and 331 BC. Some uncertainty and rebellion followed throughout the empire during the initial period of Alexander's successors. However, in the late 4th century BC, Seleucus I seems to have brought most of Iran back under control (Wiesehöfer 2001 p.106–110). There is a lack of Persian sources surrounding these events. The textual references available reflect the Greco-Roman perspective found in the many chronicles of Alexander's life and campaigns (Venetis 2012 p.142); however, these accounts provide little information on settlement in the region at the time. We know that Hyrcania was taken by Alexander in 330 BC, and it has been speculated that he may have stopped on the Gorgan Plain on his journey eastward in pursuit of the defeated Achaemenid forces (including their king Darius III, and afterwards, Bessus who likely conspired in Darius's death) (Vogelsang 1992 p. 224).

Minus several periods of "occasional nomadic inroads", the region remained under Seleucid control until it was conquered by the Parthians (also known as the Arsacids) (see below) (Venetis 2012 p.149; Wiesehöfer 2001 p.111). However, there is very little textual evidence that specifically refers to Hyrcania during the period of Seleuicid rule. An inscription, in Greek and referring to a Greek cult and associated sanctuary, said to be from Hyrcania and dating from the 3rd century BC likely reflects Seleucid administration in the region (Sherwin-White 1993 p. 81-82).

Interestingly, the administration of the Seleucid Empire relied on maintaining the administrative systems put in place during the preceding periods. Venetis (2012 p.155) indicates, that as such, the eastern provinces such as Hyrcania, continued to be considered the periphery of the empire. This statement seems to suggest, that in the imperial outlook up until this point, Hyrcania constituted a frontier region. It may be that the lack of textual evidence mentioning the region in the Hellenistic period is a reflection of this peripherality.

1.2.4 THE PARTHIANS (C. 247 BC - AD 224)

Hyrcania, appears to have been taken by the Arsacids (generally referred to as the Parthians after the region in which the dynasty originated) around 239 BC, but retaken by the Seleucid king Antiochus III (223-187) in the late 3rd century BC, before again becoming part of the Parthian realm around 188 BC (Wiesehöfer 2001 p.312). For the Parthian empire written records exist particularly in the form of Ostraca found at Parthian centres such as Nisa and Shahr-i Qumis, however these are quite scant when compared to the later Sasanian period. Contemporary outside sources, written from geographically and culturally distant perspectives by Greek, Latin and Chinese authors provide descriptions of the Parthian kingdom, its wars with Rome and its geographical extent (e.g. Strabo's *Geographia* or the description of road networks as detailed by Isidorus of Charax) (Dąbrowa 2012 p.164; Wiesehöfer 2001 p.120–125).

The Arsacids may have descended from, or been aligned with, a nomadic group (the Parni) who originated in Central Asia, and who came to occupy areas along the Atrak River and Kopet Dagh by the early 3rd century BC (Dąbrowa 2012 p.168; Hauser 2013: 731). Marcus Junianus Justinus in his work *Epitome of the Philippic History of Pompeius Trogus* tells a story of the origins of the Parthians and provides us with a sense of the proximity of the Parthian lands to the Gorgan region.

> "Because of the intercine wars they were driven out of Scythia, and so they settled stealthily in the barren land between Hyrcania and the tribes of the Dahae, Arians, Sparnians and Margianans. At first since the neighbours on their borders raised no objections, and later despite their attempts to prevent them, they spread out their territory to such an extent that they settled not only in the immeasurably wide and low plains, but also on steep and rugged hills and mountains" (Marcus Junianus Justinus 1853 XLI.1)

Strabo, writing at the very end of the 1st century BC or the very early 1st century AD, has greatly contributed to the picture of the Parthians as nomadic barbarians, and describes the countries lying to the east of the Caspian Sea in his Geography (Strabo 1917 XI.7 – XI.9). He states that upon entering the Caspian Sea from the north, the eastern bank is inhabited by nomads, after which there is a significant stretch of desert or arid land, followed by Hyrcania. Hyrcania is described as a well-watered, flat plain, with high agricultural yields, though not exploited to its full potential because it was ruled by "Medes and Persians, as also the last, I mean the Parthians, who were inferior to the former, [who] were barbarians, and also the fact that the whole neighbouring country was full of brigands and nomads and deserted regions" (Strabo 1917 XI.7.1-2).

The identification of the Arsacids as nomadic, however, has recently been questioned (Hauser 2013 p.731–732). However, possible nomadic origins, and the likely geographical origins of the Parthians (and the proximity of their homeland to the 'settled' lands of the

Gorgan Plain) is worthy of note. It suggests that in the Parthian period, the Gorgan Plain may not have been seen as a frontier of empire, but as part of the empire's heartland (Priestman 2013 p.93). This contradicts earlier interpretations of the Gorgan Wall as a Parthian feature denoting the edge of empire (Kiani 1982b; Lecomte 2007).

The downfall of the Parthian Empire came with the rebellion of Ardashir, ruler of Persis, which resulted in the taking of the Parthian capital of Ctesiphon and the collapse of Parthian dominance (Dąbrowa 2012 p.169–178).

1.2.5 THE SASANIANS AND NORTHEAST IRAN (AD 224 - 640)

The rise of Ardashir signaled the beginning of the next great Persian empire, that of the Sasanians. After warring against other local rulers in his homeland of Fars, Ardashir defeated the Parthian ruler Ardavan in 224 (taking on the title of shahan shah - king of kings - used by both the Achaemenid and Parthian rulers), and during his reign established Sasanian control or influence over most of Iran, parts of the Arabian Peninsula, and eventually Mesopotamia, coming into conflict with Rome (Daryaee 2012 p.187–88; Shapur Shahbazi 2005).

We know that early on in the Sasanian period, according to Kerdir, a 3rd century AD Zoroastrian priest, that the province of Gurgan was considered to be part of *Ērān* or *Ērānshahr* (one of the territories considered to be Iranian) (Daryaee 2012 p.178). In this period, as in the Achaemenid period, Gorgan appears to be the northeastern frontier of the empire. Archaeological survey and excavations in the Gorgan Plain confirm extensive Sasanian activity in the region including of course the building of the Gorgan Wall, major canals and earthworks, fort and campaign bases (see Sauer et al. 2013). There are however, no contemporary historical references to the construction or use of the Gorgan Wall. Radiocarbon dates indicate the wall was constructed in the 5th or early 6th century AD (Sauer et al. 2013 p.163). OSL (Optically Stimulated Luminescence) dating on brick and soil samples taken from contexts signalling the construction of the Gorgan Wall, also provide dates which fall between the late 3rd and the mid-6th centuries AD (Schwenninger and Fattahi 2013: Table 17:2). Several references to building works in the Gorgan region, are found in later sources such as al-Tabari (1999 p.152–153) writing in 9th century AD. He tells of the building of the Gates of Sul during the reign of Fayruz (Peroz – AD 457-484) which may indicate that the wall was already in use at this time (see Sauer et al. 2013 p.4).

Recently, Alizadeh (2014a p.18) has argued that the construction of features like the Gorgan Wall and similar walls and fortifications in the Caucasus were part of a wider policy of investing in infrastructure that would secure the borders of the empire, and increase revenue through the taxation of increased agricultural yields that occurred in relatively stable political conditions in the 5th century AD.

The events that precipitated the need for investment in security on the frontiers of the empire are found in contemporary Greek, Armenian and Chinese sources. These often refer to conflicts between the Sasanians and nomadic groups such as the Huns or the Hephthalites who existed north of the Gorgan Plain. References to Hephthalites are found in the Greek writings of Procopius (mid-5th century AD) in his descriptions of the Persian Wars, in Armenian in the writing of Lazar Parpeci and Elishe (both 5th century AD), and in several Chinese histories of the same period. Further references are found in al Tabari (AD 839-923), Baladhuri (9th century AD), and Mir Khvand (AD 1433/34 – 1498) all writing centuries later. Finally, the Persian epic, the Shahnamah, by Ferdowsi (c. late 10th century AD) provides a mythologized version of the exploits of several Sasanian kings and their wars with the Hephthalites (Bivar 2003, 2012; Enoki 1955 p.231; Litvinsky 1996 p.135–138).

The Hephthalites or "White Huns" are generally characterised as a nomadic group from Central Asia who posed a significant threat to the security of the north eastern frontiers of the Sasanian Empire (Grousset 1970 p.68; Humphreys in al-Tabari 1990 p.91). However, the Hephthalites were likely not the first, or the only group to have plagued the north east borders of *Eranshahr*. Various 'nomadic' groups from Central Asia appear in the textual sources between the 4th and 6th centuries AD. One of these, the 'Huns,' are mentioned as early as the mid-4th century AD in Ammianus Marcellinus, a Latin author (Bivar 2003 p.199). A century later, the Sasanian kings Bahram Gor (420-438) and Yazdgird II (438-457), are also said to have had to defend the borders in Khurasan against a nomadic group of Huns. However, it is debated as to whether these were the Hephthalites or another group known as the Chionites or Khionites (Bivar 2012; Grousset 1970 p.68).

The Armenian historian Elishe Vardapet also tells us that during the reign of Yazdgird II, war was waged against Kushans and that the king's residence was moved to somewhere near the northeastern frontier of the empire to deal with this threat (Elishe 1982 p.66; Kurbanov 2010 p.148; Litvinsky 1996 p.138). In this case, there is again much debate as to which of the central Asia groups the Kushans refer to, with both the Hephthalites and the Kidarites as possible candidates (Kurbanov 2010 p.151–152).

Interestingly, in the later 5th century AD Kavad formed an alliance with the Hephthalites to become king, even marrying into a Hephthalite family. Later, he is said to have integrated the Hephthalite armies into his campaigns against other regions. Clearly the Hephthalites were a formidable military force that at times both fought against, and were allied with the Sasanian kings (Litvinsky 1996 p.141).

The geographical and cultural origins of the Hephthalites are the subject of much debate. Interpretations are often based upon conflicting textual accounts and coinage (see Bivar 2003, 2012; Enoki 1955; Ghirshman 1948; Grousset 1970 p.67; Kurbanov 2010, 2013; Litvinsky 1996 p.135–136; Vondrovec 2014), but very little other kinds archaeological material (see Kurbanov 2013 for a recent review of the available archaeological evidence). Grousset (1970 p.67) suggests that "their rule extended from the upper Yulduz in the east (northwest of Kara Shahr) across the Ili basin to Balkhash, over the Chu and Talas steppes and the Syr Dara region as far as the Aral Sea", further indicating that by the mid-5th century AD also had Sogdia or Transoxiania (near Samarkand) and Balkh, Bactria or Tokharistan. Kurbanov (2010 p.152) tells us that their state was centered in Bactria by the mid-4th century AD, expanded to include the Kabul valley by the start of the 5th century AD, and even controlled the northern part of what is now modern Pakistan by the mid-5th century AD.

Clearly, it appears that in the case of the Hephthalites we are dealing with more than a loose confederacy of nomadic groups. Procopius (1914 Wars I,3) tells us:

> "At a later time the Persian King Perozes became involved in a war concerning boundaries with the nation of the Ephthalitae Huns, who are called White Huns, gathered an imposing army, and marched against them. The Ephthalitae are of the stock of the Huns in fact as well as in name; however they do not mingle with any of the Huns known to us, for they occupy a land neither adjoining nor even very near to them; but their territory lies immediately to the north of Persia; indeed their city, called Gorgo, is located over against the Persian frontier, and is consequently the centre of frequent contests concerning boundary lines between the two peoples. For they are not nomads like the other Hunnic peoples, but for a long period have been established in a goodly land. As a result of this they have never made any incursion into the Roman territory except in company with the Median army. They are the only ones among the Huns who have white bodies and countenances which are not ugly. It is also true that their manner of living is

> unlike that of their kinsmen, nor do they live a savage life as they do; but they are ruled by one king, and since they possess a lawful constitution, they observe right and justice in their dealings both with one another and with their neighbours, in no degree less than the Romans and the Persians".

The above passage suggests that a simplified characterization of the Hephthalites as 'nomadic raiders' is inadequate. Furthermore, Lazar Parpeci (1991 p.214–215), in his account of Peroz's war with the Hephthalites, details the military might and political organization of the Hephthalites. This fact, Litvinsky (1996 p.139) rightly points out, demonstrates that "the Hephthalites appear not merely as a group of nomadic tribes but as a state formation, on equal footing with Sasanian Iran and fully versed in statesmanship". The Chinese dynastic histories, such as those of the Toba Wei and the Liang, are another contemporary source of information on the Hephthalites (Enoki 1955 p.231; Grousset 1970 p.68; Kuwayama 2002; Litvinsky 1996 p.135–138). These accounts include the details of Hephthalite embassies to the Chinese courts, which again reinforce the notion of the Hephthalites as state instead of a loose tribal confederacy.

The threat the Hephthalites posed to the security of the empire precipitated investment in both military and agricultural infrastructure of various frontier regions throughout the empire, including the Gorgan Plain in the 5th and 6th centuries AD reflecting a strengthening of the Sasanian state (Payne 2014; Alizadeh 2014a). Given that at times the Sasanian kings were allied with the Hephthalites, it is likely that the relationship between them and the state was complex.

The Hephthalites appear to have been finally defeated by a coalition of Sasanian and Turkic powers at a battle near Bukhara around AD 558-561 and ceased being a major player in the history of the Gorgan region (Bivar 2003 p.199–200; Kurbanov 2013: 185-187). However, references to Hephthalites are still found in association with events occurring in the 7th or even early 8th century in Khurasan (Bivar 2012).

1.2.6 THE COMING OF ISLAM TO THE 13TH/14TH CENTURY AD

The end of the Sasanian dynasty came about by the mid-7th century AD with the Islamic conquests, though internal strife also played a part (Daryaee 2012 p.192–193). By 650/651, the 'Malik' of Gorgan was paying tribute to the Arab invaders; however, Arab rule over the region was not solidified until the early 8th century AD (Bosworth 2002; Hartmann and Boyle 2012).

In the 8th century AD, the city of Jurjan/Gurgan was founded, and was the capital of the province of the same name, the boundaries of which roughly equate to our modern understanding of the Gorgan Plain (Hartmann and Boyle 2012). Detailed descriptions of the geography of the region, major cities and towns, agricultural products and important historical events in the 9th to 14th centuries AD can be found in various Medieval sources. These include Baladhuri (9th century AD), Ibn Hawkal (c. AD 978), Al-Muqaddasi (AD 985), Yakut (c. AD 1225), Ibn Isfandiyar (13th century AD), and Mustawfi (AD 1281/1282–after 1339/1340) (see Le Strange 1905). By all accounts, the city (and by extension the province) prospered through the 9th and 10th centuries, reaching its zenith in the 11-12th centuries AD, before being devastated by the Mongol, and then the Timurid invasions, in the 13th and 14th centuries AD (Hartmann and Boyle 2012; Kiani 1983: 90).

1.3 ARCHAEOLOGICAL RESEARCH IN NORTHEAST IRAN

1.3.1 EARLY TRAVEL NARRATIVES AND THE GORGAN PLAIN

The antiquity of the Gorgan Wall, and many other archaeological sites and landscape features, was recognized by European travellers during the 19th and early 20th centuries AD (see inter alia Baker 1876; Hedin 1898; Le Strange 1905; Marvin 1881; Napier and Ahmad 1876; Pumpelly 1905; Rabino 1928; Vambery 1864; Yate 1900). Colonial interest in this strategic region was dominated by Russia and Britain who sponsored missions to explore the potential of an overland route through Central Asia to India. If such a route, through these harsh deserts and hostile territory, were to be traversable it would prove an opportunity for the expansion of the Russian Empire on one hand, and a threat to the British grasp on India on the other. As a consequence, much of the landscape between Northeast Iran and Central Asia was mapped and described.

These travelogues include mention of many ancient mounds or tappehs between the Alborz Mountains and the Atrak River (see Le Strange 1905 p.270; Napier and Ahmad 1876 p.99, 119; O'Donovan 1882; Vambery 1864 p.52–56; Yate 1900 p.215). They also offer invaluable information on the natural and cultural landscapes of the region, including land use and subsistence strategies, political and tribal boundaries, and routes through the region prior to modernisation programs and intensive agricultural practices that began in the 1920s (see Okazaki 1968). Furthermore, some brief, and some more in-depth mentions of the Gorgan and Tammishe Walls are found in these narratives. A thorough review of these and a summary of the proposed dates of these monuments can be found in the recent monograph by Sauer et al. (2013 p.4–17).

1.3.2 EARLY ARCHAEOLOGICAL SURVEY AND EXCAVATION

The first archaeological survey of the Gorgan Plain was conducted by de Morgan (1894) in the late 19th century AD. His map of the region provides information on the location of many tappehs and gives the course of a portion of the Gorgan Wall (Fig 1-2). Labelled, as the *Grande Muraille Kizil Alan*, it appears to run from the shore of the Caspian Sea to disappear before reaching the modern city of Gonbad-e Kabus. On this map, the majority of observed ancient sites exist to the south of the wall. However, he also indicates at least three sites with the title "*ruines de ville antique*" located immediately north of the wall (identified on his map as "Altin tépé", "Tok'hmak'h tépé", and "Söghör") and a further six sites with the "tappeh" place-name in the northern steppe. It seems that even in the earliest survey, the differences between the northern and southern portion of the plain were recognisable.

Within a few years of these investigations, Raphael Pumpelly (1905) headed an expedition across Turkestan (including parts of the Gorgan Plain and Turkmenistan) to investigate its geological and archaeological history. While this project had a much wider remit, he made many observations on mounded features that he called tumuli or kurgans. While he referred to many of these features as burial mounds, he was likely describing some of the many tappehs or mounded settlement sites that dotted the plain.

1.3.3 ARCHAEOLOGICAL INVESTIGATIONS IN THE 1930S

Early excavations in the Gorgan Plain focused on the prominent mounds or tappehs in the verdant and archaeologically more densely settled areas near the modern city of Gorgan (then known as Astrabad) (see Fig. 1-3 for the location of the sites in the following discussion). Importance was placed on the excavation of burials as they tended to result in more aesthetically appealing finds, such as those undertaken at Shah Tappeh by T.J. Arne and a Swedish team (Arne 1945). Tureng Tappeh (Database ID - KH_123), arguably one of the most well-known and archaeologically important sites on the Gorgan Plain, was also first excavated by F.R. Wulsin in the 1930s (Wulsin and Smith 1932). These excavations produced a considerable amount of material they dated to the Bronze Age (though ware types clearly representing other phases are also mentioned). The largest mound (mound A in his maps) would later prove to have a sequence extending, with some gaps, from the Neolithic through to the Islamic period (Boucharlat and Lecomte 1987 p.10–11). The excavation of over a hundred burials provided the excavators with a vast amount of pottery, figurines and small objects, but only a crude and not particularly accurate chronology for occupation at the site.

Under the rubric of the excavations at Shah Tappeh (Database ID – ARNE_142) (Arne 1945), a large-scale archaeological survey of the sites to the south of the Gorgan Wall was also initiated. Like the excavations, the survey focused on mounded sites. The survey area of the project extended the regions surveyed by de Morgan and Pumpelly and recorded archaeological sites in a more complete and systematic manner. The resultant map included the Gorgan Wall for about 70 km of its length, from Gonbad-e Kabus to Gomish Tappeh (Figs. 1-4 and 1-5). J. de Morgan's (1894) earlier survey listed thirty-two tappehs south of the Gorgan Wall (see Fig. 1-2), which were re-investigated by Arne's team. These 32 sites were assumed to represent most of the 37 tappehs or tumuli that Rabino (1928) also reported in this southern portion of the plain. Ultimately, the Swedish survey mapped 303 sites between the Gorgan and Karasu Rivers, with pottery collection having been carried out on at least 90 sites where sherds were clearly visible. Furthermore, Arne (1945 p.15–17) mentioned that they observed, but did not have a chance to map, all of the water courses, ancient canals, nomadic encampments and villages that were present in the area (see Fig. 1.4).

Further reconnaissance was undertaken in 1937 by Lester S. Thompson (1938) with the goal of understanding the relationship between the geological character of the plain and many of its extant archaeological features. He gave a significant treatise on the Gorgan Wall and its construction, the forts along its length and some of the large mounded sites to the south of it, again demonstrating the great density of settlement in the southern part of the plain. He also made some of the earliest, though now likely erroneous, observations about the association between settlement in the northern plain and water control systems.

The importance of aerial photography for archaeology was also being demonstrated to great effect by Schmidt (1940) in Iran in the 1930s. His aerial survey of the Gorgan region mapped at least one hundred sites indicated as either tappeh or settlement ruin on his overall map of the survey (Schmidt 1940: Map 2) (Fig. 1-6). Again though, of these sites only three exist north of the Gorgan Wall, and are in its immediate proximity.

1.3.4 ARCHAEOLOGICAL INVESTIGATIONS IN THE 1960S AND 1970S

Moving forward in time and approach, excavations were undertaken at Yarim Tappeh (KH_79) and Tureng Tappeh (KH_123) in the 1960s and 70s by international teams (see Fig. 1-3 for site locations). Focus had shifted from the excavation of graves (with little regard for the holistic picture of settlement) toward establishing a reliable pottery sequence and applying new scientific methods. Yarim Tappeh which appeared to have settlement ranging from at least the 5th millennium through to the Iron Age and Parthian periods (c. AD 200) was recognized as a key site in establishing a reliable chronology in the region (Crawford 1963 p.268), though little has been published on this work to date (however, see Stronach 1972). Furthermore, Tureng Tappeh was revisited in the 1960 and 70s by a French team (Boucharlat and Lecomte 1987; Cleuziou 1985; Deshayes 1963; Deshayes 1967; Deshayes 1969; Deshayes 1973; Deshayes 1974; Deshayes 1975; Deshayes 1979). These excavations identified occupation from the Neolithic through to the Islamic period, with, as the excavators pointed out, the potential to provide a stratified pottery sequence comparable to Tappeh Hissar (Boucharlat and Lecomte 1987). Unfortunately, to-date, only the materials from the late Parthian, Sasanian and Islamic periods have been published in their final form. However, analysis and publication of the notes and collections held by the original excavators are underway (pers. comm. Regis Vallet 2016).

A further large-scale survey was conducted by the Hiroshima University Scientific Expedition to Iran in the 1970s (Shiomi 1976; Shiomi 1978). This systematic survey, conducted over two seasons, recorded 224 mounded sites in an area of approximately 4000 square kilometres south of the Gorgan River (Fig. 1-7). The surveyors recorded the morphology of sites, contemporary land cover, and drew up detailed topographic maps (Fig. 1-8 to 1-19). Unfortunately, while the remit of the project was to cover the entirety of the plain, the survey was never finished due to inability of foreign teams to gain access to Iran after 1979; equally analysis of the pottery was never completed or published.

One of the most significant contributions to the present study of the Gorgan Plain was undertaken by Iranian archaeologist M.Y. Kiani, who made detailed maps of the Gorgan Wall and its surrounding landscape from aerial photographs (Kiani 1982b; Kiani 1982a; Kiani 1984) making him a methodological predecessor of the *GWP* and the *PNP*. His informative series of maps charted the course of the Gorgan Wall and the sites in its hinterland, and also hinted at ancient landscape features such as canals and hollow ways (ancient routes characterized by linear depressions) (Fig. 1- 20 – Fig. 1-30).

Kiani believed that the Gorgan Wall, and many of the sites that were found by his project were Parthian (based on what is now known to be his erroneous analysis of the pottery). He conjectured that the wall had been built during the reign of Mithridates II (123-87 BC) due to pressure from 'northern invaders' (i.e. nomads) and possibly repaired during the reign of Khosrow Anushiravan in the Sasanian period (Kiani 1982b p.38). Despite his belief in a Parthian date, he noted that many scholars believed it to be Sasanian (Kiani 1982b p. 11). Kiani's incorrect dating of the wall was echoed in recent years by Lecomte (2007) until it was finally put to rest by the radiocarbon and OSL dates obtained by the Gorgan Wall Project (Nokandeh et al. 2006; Omrani Rekavandi et al. 2007; Sauer et al. 2013).

1.3.5 RECENT SURVEY AND EXCAVATION

Perhaps the most famous archaeological monument in the region is the Gorgan Wall, constructed during the Sasanian period (AD 225-640) to protect its northern frontier and control movement into and out of the empire. The Gorgan Wall stretches across the entirety of the west-east axis of the plain from near the shores of the Caspian Sea to the eastern Alborz Mountains; a distance of nearly 200 km. The wall, and the archaeological landscapes of the Gorgan Plain were the focus of study of the *Gorgan Wall Project* (henceforth *GWP*) from 2005-2009 and the *Persia and its Neighbours: The Archaeology of Late Antique Imperial Power in Iran Project* (henceforth *PNP*) since 2013; both project were a joint undertaking between the University of Edinburgh, Durham University, and the Iranian Cultural Heritage, Handicraft and Tourism Organisation (ICHHTO).

The *Gorgan Wall Project* focused on the Gorgan Wall and its immediate hinterland (c. 5 km on either side). Excavation took place at several places along the wall, and at several forts and settlements. This work resulted in an unquestionable Sasanian date for the construction of the Gorgan and Tammishe Walls and a reliable ceramic sequence for the Mid to Late Sasanian period. Many of the rectilinear forts and large geometric enclosures excavated also proved to be Sasanian and were a part of the package of defensive features that appear to go hand in hand with significant investment in water control systems identified by the landscape survey (Nokandeh et al. 2006; Omrani Rekavandi et al. 2007; Omrani Rekavandi et al. 2008; Sauer et al. 2013). Excavations at the site of Qelich Qoineq also provided absolute dates for a ceramic assemblage dating to the Iron Age III period (c. 8th-5th centuries BC). Equally, the survey, guided by data acquired from the remote sensing of satellite imagery, field checked c. 50 sites dating from the Bronze Age to the Islamic periods, as well as numerous water control features, and roads (hollow ways) (Wilkinson et al. 2013).

Furthermore, in the last few decades an immense amount of work has been carried out independently by Iranian archaeologists from the ICCHTO in Golestan province. Site visits and ceramic collections from nearly 800 sites, have resulted in the publication of ten maps of settlement by period (Abbasi 2011) (Fig. 1-31 to 1-40). However, neither a full explanation of the ceramic criteria used in dating, nor details of the actual assemblages is as yet available.

Since 2012, a second phase of research has been undertaken by the universities of Edinburgh, Durham, St Andrews, Bradford, Centre National de Recherche, Paris, and Université Paul Cézanne Aix Marseille iii in collaboration with the ICCHTO. The *PNP* has expanded upon the work undertaken during the *GWP* to investigate frontier zones of the Sasanian Empire in Iran, Georgia, Azerbaijan, Turkmenistan, Oman, Iraq and Syria through field work and remote sensing of satellite imagery (Hopper and Omrani Rekavandi forthcoming; Lawrence and Wilkinson 2017; Sauer et al. 2015, Sauer et al. 2017; Shumilovskikh et al. 2016).

1.4 THE CURRENT RESEARCH - AIMS AND OBJECTIVES

As part of the *PNP*, this thesis intended to investigate rural, urban and nomadic patterns of settlement and land use on a Sasanian frontier, and more particularly to examine how these patterns manifested in relation to a frontier with a clear physical boundary like the Gorgan Wall. The aim was to build a more detailed picture of the Sasanian frontier landscape that had emerged during the course of the earlier *GWP* based on a more in depth analysis of the survey data collected during the *GWP* by myself and other members of the team over several field seasons (Wilkinson et al. 2013). The preliminary results of this research indicated that the Gorgan Wall was part of a larger pattern of investment in defence, represented by forts, campaign bases, and canals. However, our fieldwork focussed primarily on the wall corridor and/or large sites that were easily identifiable on the CORONA imagery; this resulted in the overrepresentation of certain site types, and a small, geographically biased sample. Furthermore, many of the Sasanian sites identified appear, based on further investigation and excavations, to be representative of military activity (Sauer et al. 2013). Furthermore, the historical accounts of this period, while providing important information on the reasons why the Sasanians were investing in such an elaborate frontier defence system (i.e. the threat posed by groups such as the Hephthalites), provide little information on the interactions between sedentary and mobile communities beyond war and imperial politics.

Overall, this left us with little understanding of the urban or rural settlement pattern, agricultural investment strategies, and the relationship between agricultural and pastoral communities. All of these factors are crucial to building a more rounded picture of this frontier. It therefore quickly became clear that a larger dataset needed to be sought, and the temporal remit of this thesis needed to be expanded; the settlement and land use patterns of the Sasanian period could only really be evaluated in comparison to those of the preceding and succeeding periods.

The uncertainty of being able to return to the field to collect further data necessitated the use of a methodology that did not rely on further intensive on-the-ground survey to supplement the current dataset. As such, a systematic investigation of the historical CORONA imagery held by the project was undertaken. This resulted in the identification of thousands of archaeological sites and features. Furthermore, as discussed in the previous section, a number of archaeological surveys have been conducted in the region over the last century or so producing a vast amount of data that could also be utilised. Therefore, the information gathered from the remote sensing exercise were integrated into a database linked to a GIS and cross-referenced with published survey and excavation data from the region (Abbasi 2011; Arne 1945; Cleuziou 1985; Crawford 1963; Boucharlat and Lecomte 1987; Kiani 1982b; Nokandeh et al. 2006; Omrani Rekavandi et al. 2007; Omrani Rekavandi et al. 2008; Sauer et al. 2013; Shiomi 1976; Shiomi 1978; Wulsin and Smith 1932). This resulted in a database of c. a thousand archaeological sites with attached spatial and chronological information of varying certainty and resolutions and provided a much larger sample from which to work.

Analysis of these data allowed for:

1. the identification of patterns of land use and settlement relating to specific environmental zones and
2. the social, economic and political situations of particular periods lasting, perhaps a few hundred years.

In the context of landscape archaeological terminology, these are what Wilkinson (2003) identified as "signature landscapes".

This thesis reconstructs, as far as possible, Late Iron Age through Islamic settlement and land use patterns on the Gorgan Plain. By comparing and contrasting signature landscapes relating to particular time-periods and environmental zones, changes in urban and rural settlement forms, subsistence strategies and connectivity through time are discussed. These results have been used to address a number of interrelated research questions, namely:

1. What was the impact of imperial (Achaemenid, Parthian, Seleuicid, Sasanian) investment in this landscape on settlement patterns, subsistence economies, and local and regional connectivity? What is the timing of these impacts?
2. How do these landscape investments and patterns of settlement compare to those of earlier and later periods? Can we see the difference between landscape signatures resulting from imperial or state-directed initiatives (reflecting different types of polities), and local responses to widening socio-political networks and economic opportunities?
3. Finally, broadening the scope, these trends will be discussed within the context of the impact of later territorial empires on the landscape in the greater Near East beginning in the 1st millennium BC . Are particular landscape signatures the result of a specific type of imperial strategy?

The current study aims to increase our understanding of long-term settlement trends in the Gorgan region, while critically evaluating the available datasets, and of the usefulness of data generated through the remote sensing of satellite imagery to answer such questions. It will also add to the growing body of work focusing on landscape transformations, and in particular signature landscapes, associated with territorial empires in the ancient Near East (e.g. Alizadeh 2011, 2014; Altaweel 2008; Parker 2002; 2003; Payne 2014; Ur 2005; Whitcomb 2014; Wilkinson 2003; Wilkinson et al. 2005).

2 A MULTI-SCALAR LANDSCAPE APPROACH TO THE STUDY OF THE LONG-TERM SETTLEMENT AND LAND USE ON THE GORGAN PLAIN

This chapter discusses the development of archaeological theories regarding the study of empires, frontiers and mobile pastoralism that are applicable to this study. Understanding how we define and identify empire in the archaeological record is crucial if we wish to discuss the impact of a particular polity on the landscape of a region. From at least the middle of the 1st millennium BC, the landscapes of the Gorgan Plain were shaped by the waxing and waning of imperial interest in this region. In certain periods this region also formed a frontier zone, and as such it is important to trace the development of archaeological thought regarding how we conceptualise and discuss frontiers. As it will be shown, frontiers are far more than simplistic lines on maps denoting the extent of imperial influence, but complex overlapping zones that can also act as important points of cultural contact. This is especially true in regions such as the Gorgan Plain that have a long history of interaction between mobile pastoral and sedentary agricultural communities, though these terms imply a dichotomy much more simplistic than the multitude of subsistence strategies that inhabit a place on the spectrum between these poles (see Abdi 2003). Therefore, I will also review the current state of research into the archaeology of mobile pastoralism as it relates to the greater region. Finally, I will discuss how the methodologies and techniques common to landscape archaeology can provide an overarching framework for the study of these themes.

2.1 EMPIRES IN ARCHAEOLOGY

"Empires are by nature unwieldy beasts, as difficult to capture descriptively as they are to manage" (D'Altroy 2001 p.125).

2.1.1 DEFINITIONS

The study of ancient empires has traditionally reflected either a very western (e.g. using the Roman Empire as a model) or modern view of imperialism (e.g. the British Empire) (see discussion in Areshyan 2013 p.4; Morrison 2001 p.9). However, in recent years, there has been a movement towards a recognition of the diversity of empires, and the different trajectories of development that can facilitate useful comparisons across time and space (Alcock et al. 2001). Studying empires at different scales, especially the local and regional (e.g. Areshyan 2013; Khatchadourian 2014) and from different perspectives such as the frontiers (Alizadeh 2014a; Sauer et al. 2013) is imperative. However, It should be kept in mind that it probably made very little difference to the historical participants which political entities would and would not have been considered empires by modern scholars.

Difficulties in defining and describing empires, and understanding the imprint they leave in the archaeological record, stem from their size and complexity. Empires are states that are territorially expansive, and incorporative of many diverse socio-political, and cultural entities; often this involves one dominant group exerting power over many different ethnic groups. The relationship between the imperial state and the incorporated polities is one of control through various means that can include domination, coercion or other strategies - and often a combination of more than one (Doyle 1986; Goldstone and Haldon 2009 p.6; Parker 2003 p.525; Rogers 2012 p.213; Sinopoli 1995; Subrahmanyam 2001 p.43).

Mann (1986) describes the structure and history of all societies as an intertwined network of different types of social power - ideological, economic, military, and political. As such, control is maintained through many different expressions and uses of these types of power. Political theorists have long debated how one polity comes to dominate another resulting in different ways of viewing the process of imperial expansion (see Doyle 1986 p.20–30 for an overview). Doyle (1986 p.19–20) favours an explanation which emphasizes the interaction between “societies of metropoles” and “societies of peripheries” with the former having the ability to dominate the latter by virtue of having a strong government, and shared political ideology (or a “transnational extension of the economy, society, or culture of the metropole”) and an economy generating different resources. The resulting Interactions between the metropoles and the periphery – domination, subjugation, collaboration – result in different forms of empire.

But when do empires emerge? In Mann’s (1986 p.134) view, polities that could be characterized as empires emerge with Sargon of Akkad in Mesopotamia in the second half of the 3rd millennium BC. Though expansive, he asserts that the way this polity, and its successors over the next thousand years exerted power characterise them as “empires of domination”; power comes not through direct control over extensive territory but as more specific control of people or polities. These societies could also be understood, as Schloen (2001) argued for Late Bronze Age Ugarit (following on the ideas of Weber (1978) and

Eisenstadt (1971) in distinguishing the structures of these polities as different from those of the mid-1st millennium BC onwards) as patrimonial regimes.

From sometime in the mid-1st millennium BC however, a more familiar model of empire, the territorial empire – one that is expansive and incorporative of large, but not necessarily contiguous, territories over which it exerts effective control – emerges. One could argue that from the Neo-Assyrian period (c. 9th to 7th centuries BC) there appears to be a marked difference in the way political structures, territorial control and ideologies are created and maintained resulting in a shift toward a territorial empire[4] (see Parker 2002 p.376). These structures are then utilised and adapted in various ways by subsequent Near Eastern empires (the Neo-Babylonian and Achaemenid), and arguably continued to influence the Seleucid, Parthian and Sasanian Empires (Bedford 2009 p.30–31; Wiesehöfer 2009 p.66, 86). Whether one then considers the Neo-Assyrians as a territorial empire or another form of the earlier Mesopotamian "empire of domination" (Mann 1986 p.248–250), one can argue for a change in the way ideological power is used by the ruling elite to create a particular type of world view (Bedford 2009 p.61; Mann 1986 p.236).

This "world domination" or "world order" ideology justifies an elite who utilize military means to dominate, and therefore secure peace and prosperity for the empire (Areshyan 2013 p.9; Bedford 2009 p.48; Woolf 2001 p.317–318). This is exemplified in the Old World by the notion of the 'axial age', the roughly thousand-year period between the 1st millennium BC and the mid-1st millennium AD, also sometimes referred to as the "golden millennium of empire formation" (Hopkins 2009 p.178). During this time frame the doctrine of many of the world's dominant religions took shape, and these ideologies are cited as playing a crucial role in the development of the territorial empire. However, the role that these ideologies played in the emergence of imperial forms has been questioned; the concept cannot explain the diversity we see in empire types emerging during this period, and their political organisation (Goldstone and Haldon 2009 p.3–4).

Outside this model, we find several examples of polities that share traits of empire associated with size and complexity, but where this encompassing ideology is difficult to identify due to either the lack of textual evidence (Schreiber 2001) or because religion and

[4] Mann (1986 p.248–250) asserts that the Roman Empire is the first true territorial empire, but he does identify fundamental shifts in the structure of empire and how the different types of power are exerted in the Neo-Assyrian and Achaemenid Empires.

culture were not used as a unifying mechanism, as is the case for the steppe polities of Inner Asia, or what are sometimes termed 'nomadic empires' (Rogers 2012 p.240). The characteristics, and by extension, definition of an empire therefore appears to change significantly depending upon your vantage point.

Perhaps, because of its rise during the golden millennium of empires, the fact that it is well documented, or its longevity (and by extension success?), the model of the Roman Empire has heavily influenced forms of empire in the Western world since its demise (i.e. from the Byzantine to the British Empire). The predominance of the Roman Empire in defining the form of socio-political, economic and military power that constitutes empire has been noted as a common feature in much of the literature up until the later 20th century AD (Areshyan 2013 p.4; D'Altroy 2001 p.125; Morrison 2001 p.1–2, 9; Woolf 2001 p.312). While some succeeding empires may have emulated the glories of Rome, using Rome as a comparison for all empires is potentially anachronistic and misleading; however, concepts and terminologies originating in a Roman Empire context are commonly used in discussions about empires in general (see Bedford 2009 p.46 for examples; Doyle 1986 p.137; Mann 1986 p.160).

Calls for moving away from exclusive or structuralist definition of empire that requires the quantification of features (often held up against the well-known metrics of Rome) or that employ a sort of checklist of imperial features, and towards descriptions which allow for variations in imperial form to be recognised has grown in recent years (Goldstone and Haldon 2009 p.7; Rogers 2012 p.207–209; Subrahmanyam 2001 p.43). Ultimately, empires are as diverse as the populations and regions they encompass.

2.1.2 APPROACHES TO NEAR EASTERN EMPIRES: THE ACHAEMENIDS TO THE SASANIANS

How should we approach the study of the empires that are temporally and spatially relevant to this study? For example, the contemporaneity of the Sasanian Empire with the Roman (and Byzantine) Empire might suggest similarities, as does the temporal inclusion of these empires, along with the Achaemenid, Seleuicid and Parthian empires in the 'golden millennium'. Like the Roman/Byzantine Empires, the Near Eastern Empires were territorially expansive and incorporative, and, as evidenced in the historical sources, exercised control over other socio-political entities. However, to understand the development of these Near Eastern empires, it is perhaps more appropriate to take a local perspective than it is to look west to Rome. The networks of the Roman Empire were very much rooted in a system in which a connectivity facilitated by the Mediterranean Sea had existed for thousands of years (see Horden and Purcell 2000) – this allowed for, among other things, the movement of troops via sea transport. In the Sasanian Empire for instance, geography contributed to a very different type of connectivity and perhaps even facilitated a stronger sense of regionalism (see section on *Identifying Empire* below). This same sense of regionalism is also apparent in the Achaemenid and Parthian periods (see Chapter 4). In fact, it has been argued that the geography of the Iranian plateau impacted on control, connectivity and regionalism as far back as the mid-late 4th millennium BC (e.g. Hopper and Wilkinson 2013; Petrie 2013)

Political organisations, ideologies, infrastructure and networks that seem to have emerged with the Neo-Assyrian Empire, were adapted by subsequent Near Eastern territorial empires, resulting in some continuity in territory and regional administrative structures, though how control over its incorporated territories was managed would have changed through time (Areshyan 2013 p.6; Bedford 2009 p.47; Khatchadourian 2013 p.110; Sinopoli 1995 p.5; Wiesehöfer 2001 p.153; Wiesehöfer 2009 p.86). Using the Sasanian Empire as an example, this can be clearly illustrated. The first Sasanian king Ardashir took on the title *shahan shah* (kings of kings) utilized by the previous Persian dynasties to denote his rule over all other rulers clearly demonstrating a 'world domination' ideology. His reign saw the expansion of territory and the incorporation of lands considered *Eranshahr* (those belonging to Iran as established during the Achaemenid period) (Daryaee 2009 p.177–78). Equally, as Rollinger (2012) argues, there is evidence for similarities in rituals described in the 3rd millennium BC in Mesopotamia that bear striking similarities to accounts from the reign of the Sasanian king Khusrau I. However, as Canepa (2010 p.579) suggests, the Sasanians never sought to recreate previous empires, but they fully engaged with the visual remnants (i.e. the Achaemenids) to suit their own needs, manipulating "wider cultural memor[ies]".

2.1.3 IDENTIFYING EMPIRE

A key, and almost universally recognised, characteristic of empires is that they are culturally, politically, and geographically diverse, and that this diversity is accepted and even exploited by imperial powers (Barfield 2001 p.30; Schreiber 2001 p.71; Subrahmanyam 2001 p.43). However, from an archaeological perspective this diversity means that within an empire, there might be significant regional variation in material culture. Therefore, defining the extent of an empire, or the extent of its influence based solely on physical evidence can be extremely difficult. In the case of many Old World empires, such as the Achaemenid Empire, we can utilise textual sources or inscriptions that give us lists of imperial territories and their political relationships to the central political authority in an empire. While useful, these sources do not always give us an indication of the many nuanced relationships occurring between empire and local communities. Equally, there are instances where textual sources are scant or non-existent. The physical imprint of 'empire' and its regional variations is important for understanding different ways in which power was expressed and control maintained. How then do we recognise 'empire' or its impact in the archaeological record?

Equating the spread of certain ceramic types with imperial control is clearly simplistic and can result in misleading conclusions equating pots with people (or equating the lack of certain types of material culture with absence) (Glatz and Matthews 2005 p.59; Schreiber 2001; Smith and Montiel 2001). In the case of the Sasanian Empire, there are significant difficulties in identifying any sort of pan-Sasanian ceramic assemblage (Mousavi and Daryaee 2012 p.1078; Priestman 2013 p.530).

Significant differences in the densities of ceramic types between regions may give some indication of economic boundaries; Da Costa (2011) for instance has demonstrated interesting correlations between the drop off in specific ceramic types and the administrative boundaries of two provinces (Palaestina Secunda and Arabia) of the Roman Empire in what is now modern Jordan. Textual sources indicate that the taxation of goods moving between provinces hampered free trade. This in turn seems to have prevented the spread of ceramic types in large numbers across these boundaries. However, this type of interactive dynamic might be more difficult to detect without textual information on economic policies.

Because of a lack of textual evidence, methodologies for recognising empire and imperialism in the archaeological record have received more focus in the Central and South America (Schreiber 2001; Smith and Montiel 2001). Here, scholars have identified a need not just for identifying the extent of empire, but more importantly for determining whether a polity can be defined as an empire at all based on the archaeological evidence.

Archaeological traces of empire can include a diverse and complex urban centre, evidence of power over other territories or polities visible in the movement of goods, investment in agricultural, communication or military infrastructure, and the rapid depopulation of some areas representing the forced movement of populations (Glatz 2009 p.134; Schreiber 2001 p.71–74; Smith and Montiel 2001 p.247–250). Equally, Smith & Montiel (2001 p.247–250) also emphasise what they call evidence for international influence in trade, investment in frontiers (and the centralisation of neighbouring polities on the frontiers), or traditions associated with the empire that are taken on by peoples outside the empire's sphere of influence, though the last of these leave room for considerable ambiguity in interpretation.

Identifying territories under the control of empire through the presence or significant increase in imperial forms of material culture or their local imitations has also been suggested (Schreiber 2001 p.73–74; Smith and Montiel 2001 p.249). However, it seems likely that this is only one way, of many, in which the relationship between an empire and a subjected territory might manifest as it somewhat underestimates the strength of local tradition in the face of imperial control. Trying to identify signifiers of 'empire' (i.e. ceramic forms typical of an empire's core region) can blind us to nuanced political and social situations; therefore, the imprint of 'empire' in a particular region will reflect its political relationship with the imperial centre – adoption of imperial forms does not signify wholesale acceptance of imperial ideology (Khatchadourian 2013; Khatchadourian 2014; Ristvet et al. 2012; Wiesehöfer 2009). "The participation of subalterns in imperial formation and re-formation lies somewhere between the unwitting acceptance of imposed official ideologies and the calculated tolerance of such ideologies as a cost of subjugation that is outweighed by its material benefits" (Khatchadourian 2013 p.115). In this way, the material remains associated with a known-period of imperial domination in a subjugated province will reflect an amalgamation or reformulation of imperial influence and long-held location tradition that is only detectable if the long-term development of a region is studied (for an example see Newson 2015). I would argue that recognising the impact of empire in the archaeological record relies not only on identifying patterns associated with imperial expansion, and investment, but understanding these patterns in the context of long-term local and regional developments.

2.1.4 LANDSCAPES OF TERRITORIAL EMPIRES

Parker (2003) has suggested that several strategies employed by the Neo-Assyrian Empire are visible in the archaeological landscapes of southeast Anatolia. These interpretations are aided by the rich textual record that exists for this period, indicating among other things, the forced resettlement of populations. One of the visible imprints he therefore suggests results from the Neo-Assyrian strategy of settling populations in peripheral regions investing in both agriculture and security in doing so. As such, in some areas there is a significant increase in newly founded villages connected to a regional imperial centre.

Arguably, this regional pattern is part of a much larger phenomenon occurring across much of the Near East in the 1st millennium BC. Wilkinson (2003 p.211–213) has observed that the increase in dispersed rural settlement, especially in previously marginal areas, along with the intensification of irrigation systems may "provide a "signature" of territorial empires. The structure of settlement patterns may therefore correspond to a range of underlying processes that prevailed when larger territories came under a single overarching administrative control". However, the extent to which this phenomenon is related to direct involvement by territorial empires in landscape transformation can be debated. Of particular importance in this study is the consideration of the difference between imperial, or state level influence and impact (these can be considerably different), and local or regional responses to external influences and increasing connectivity.

What seems clear is that the deployment of particular strategies of control result in particular landscape signatures. These strategies can involve agricultural intensification in core settlement zones, or extensification into marginal or previously unsettled regions[5]. Evidence for this can include investment in irrigation systems, or the (re)settlement of populations in new regions. While the strategies and resulting landscape signatures of the Neo-Assyrian Empire are a good example of this (see Altaweel 2008; Ur 2005; Wilkinson et al. 2005), the climax of this trend seems to be found the Sasanian or contemporary Roman/Byzantine periods in the respective parts of the Near East, Caucasus and Central Asia (Wilkinson 2003 p.211–213). Recently, the idea of 'Sasanian landscape signatures'

[5] In this case, agricultural intensification is characterised by the increasing of production in already cultivated areas. Agricultural extensification is used to indicate a strategy in which cultivation, and in some cases irrigation, is extended into agriculturally marginal, or previously under-exploited regions.

building on Wilkinson's concept has received serious attention by several scholars (Alizadeh 2014a; Whitcomb 2014). Significant investment by the Sasanian Empire in defensive and agricultural infrastructure is evident various parts of Iran, Iraq, and Azerbaijan (Adams 1965; Alizadeh and Ur 2007; Alizadeh 2011; Alizadeh 2014a; Asadi et al. 2013; Hartnell 2014; Moghaddam and Miri 2003; Moghaddam and Miri 2007; Sauer et al. 2013; Wenke 1975). The imprint of this investment takes various forms reflecting the diverse geography of these regions and their respective roles as heartlands and frontiers.

The current study aims to add to this emerging body of work by comparing the signature landscapes of the Gorgan Plain, including that of the Late Iron Age through Parthian periods, and the Sasanian period, with each other, and both earlier and later evidence for landscape investment, settlement and land use. Ultimately, these signatures will be evaluated in light of the particular landscape signatures that have been associated with specific imperial strategies in other parts of the Near East.

2.2 FRONTIER STUDIES IN ARCHAEOLOGY

Contemporary studies of frontiers in archaeology generally reflect a recognition of the multifaceted, overlapping and dynamic nature of frontiers (Eaton 2005; Glatz and Matthews 2005; Lightfoot and Martinez 1995; Rodseth and Parker 2005). Frontiers can be defined as distinct from borders in that they are zones as opposed to the lines we see so clearly drawn on maps (Elton 1996 p.3; Parker 2002 p.373; Rodseth and Parker 2005 p.10). Lattimore's (1951) work on the Chinese frontiers was influential in promoting early ideas about frontiers as composed of multiple zones. These fuzzier zones, and solid linear boundaries sit at opposite ends on the conceptual spectrum of boundary types (Parker 2002 p.374), with impermeable linear boundaries generally a characteristic of modern nation states as opposed to ancient polities (see Donnan and Wilson 1994). The Gorgan Plain, as will be considered, is an interesting case, however, as a linear boundary (the Gorgan Wall) is an important element of the Sasanian period frontier. As zones, frontiers are important points of culture contact where identities, and political and social affiliations are formed and reformed both at different scales, and through time (Eaton 2005 p.52; Lightfoot and Martinez 1995 p.472; Rodseth and Parker 2005 p.12). This contact can cement ethnic boundaries (Barth 1964) or result in 'creolization' or 'syncretisation' in material culture, and social systems (Lightfoot and Martinez 1995; Perdue 2005; Smith 2005).

2.2.1 FRONTIERS OF EMPIRE

The frontiers of the Roman Empire are probably the best studied of any ancient polity (see Boozer 2013; Breeze et al. 2013; Collins 2012; Elton 1996; Fisher 2004; Hekster and Kaizer 2011; Hingley 2012; Mathisen and Shanzer 2011; McIntosh and Collins 2014; Parker 2006 to name but a few). The geographical scope of these works cover frontiers as diverse in form and geography as Hadrian's Wall in the north of England to the *Limes Arabicus* in Jordan and Syria. Perhaps, because they have been the focus of study for so long, there is a significant amount of scholarship on the social and cultural aspects of these frontiers, as well as political and militaristic ones (see for example Boozer 2013; Dirven 2011; Hingley 2012). Elton's (1996) work, especially, has been highly influential in promoting the idea of the frontiers as "overlapping zones" containing different types of boundaries, instead of just simplistic borders.

This concept can and should be applied to the study of frontier landscapes of Near Eastern Empires. In particular, the notion of multiple boundaries composing a frontier zone is helpful when trying to understand the northern frontiers of the Sasanian Empire, where a clear physical boundary existed. On the surface, the construction of defensive long-walls, like we see in these regions (i.e. the Gorgan Wall, Ghilghilcai Wall, Derbent Wall), or the fortification of natural boundaries (like the Dariali Gorge of the Caucasus Mountains) embody a clear political or militaristic boundary and appear to represent a particular imperial response to the threat posed by a specific enemy; that is 'barbarian' or nomadic groups who existed beyond these borders. However, as is the case for long-walls on the frontiers of the Roman Empire and the Chinese Empires, these boundaries were neither solely militaristic nor impermeable (Hingley and Hartis 2011; Lattimore 1951).

As Lattimore (1951) pointed out in his influential work *Inner Asian Frontiers of China,* the frontier between imperial China and the mobile pastoral societies of the steppe was not a clear line, but instead was composed of several zones. As such, "The line of contact inevitably deepened into a margin" (Lattimore 1951 p.542). While long-walls or fortifications may serve military, or even economic functions by controlling or taxing trade across the frontier, they did not wholly limit the movement of people and ideas. However, physical borders, as Lightfoot and Martinez (1995 p.482) note, offer us an interesting opportunity for observing the interaction between real and perceived boundaries:

"Clearly defined boundaries may be relatively rare and associated with distinctive circumstances that deserve special study. For examples, walls and guarded borders separating ancient states from their hinterlands have always been permeable to some peoples and materials. Even today along some national boundaries that are essentially militarized zones, which serve as visible barriers to communication and population movements, contemporary borderlands communities transcend geopolitical demarcations as evidenced by the numerous social, kin and political networks that link peoples on both sides of the borders."

A well-studied example of the interaction between sedentary communities and mobile pastoralists on an imperial frontier is the *Limes Arabicus* of the Roman/Byzantine Empire. Over the last 30 years considerable debate has occurred about the function of the *limes*, though scholars generally agree that it was not a defensive line, but a zone marked by fortifications, settlements and route systems that developed on the arid margins between settled communities and mobile pastoral groups (Banning 1987; Fisher 2004; Mayerson 1986; Mayerson 1989; Parker 1984; Parker 1987). How the interaction between these groups has been characterised however spans the spectrum from beneficial mutualism (Banning 1986) to the classic model of antagonism only kept in check by strong policing of the frontier by imperial agents (Parker 1987). Mayerson (1986; 1989 p.71) has pointed out, quite insightfully, that these views of the *limes* result from interpretations made at different scales and from different data sources. While, during certain periods, the Roman Empire may have used the infrastructure of the *Limes* to keep tabs on large-scale movements of nomadic groups, the frontier likely did not limit activities like trade, or the movement of herds. Mobile pastoral tribes also served an important military function, as in the 5th and 6th century AD when they acted as paid frontier security for a Byzantine Empire needing to concentrate its main forces elsewhere (Fisher 2004). Ultimately, as Fisher, points out:

"It is now clear that the limes can no longer be considered a fortified line where the primary concern was to protect those that lay on one side from those on the other; rather, the limes in southern Arabia and Palestine is best understood as a settled zone of frontier country where the nomadic and sedentary populations merged, and where forts and fortified buildings existed to serve a number of diverse purposes" (Fisher 2004 p.54).

This idea of multiple manifestations of a frontier has not yet been fully explored in regards to the Gorgan Plain. To date, more focus has been placed on the military aspects of frontiers (i.e. that is the Gorgan Wall and fortified sites of the Sasanian period), but have yet to address the economic, and often less tangible social, cultural, and even ideological frontiers that also existed in this region, and changed through time (see Boozer 2013 for an interesting analysis of ideological and conceptual frontiers associated with Rome's Egyptian borderlands)[6]. A major stumbling block in any attempt to do this, however, for the Gorgan Plain, has been a lack of direct evidence for many of the activities of mobile pastoral groups in the archaeological landscape (see Potts 2014). Relying, wholly on textual sources can provide a lopsided view. How then, do we create a more balanced picture of the interaction between empires and mobile pastoral groups on the frontiers?

2.3 THE ARCHAEOLOGY OF MOBILE PASTORALISM

> *"It was strange to see the green fertility of the belt south of the Gurgan and then beyond its north bank the steppe fading into tan desert. This contrast, in plain words, shows the reason for the great wall. It protected the tiller of the soil against the nomad of the steppe and desert"* (Schmidt 1940 p.58).

There is a long tradition of characterising mobile pastoralists, or more commonly 'nomads', as the 'other', separate from settled communities, with interactions between the two portrayed as solely antagonistic (Wendrich and Barnard 2008 p.10). This is particularly apparent in the textual sources reviewed in chapter 1, and has resulted in the common use of diametrically opposed terms such as 'nomad and settled', and 'desert and sown' in many historical accounts and much of the literature about mobile pastoral groups. Such dichotomies ignore variations in subsistence strategies, and the long history of interactions, both antagonistic and mutually beneficial, between mobile and sedentary communities (Bates 1971; Forbes 1995 p.331; Rosen 2008 p.130). Along the continuum between a completely sedentary agriculturalist and a fully nomadic pastoralist, there are many economic strategies involving both variables (Abdi 2003 p.399; Cribb 1991 p.16–17; Finkelstein and Perevolotsky 1990 p.68; Khazanov 1994 p.20–24). The term mobile pastoralism, as an overarching category, characterises strategies along this continuum that involve a significant reliance on the herding of animals and require some degree of movement. However, there is considerable debate as to the types, definitions and specificity of categories that we should be employing to describe these strategies. The

[6] In the case of our own project, while very significant and valuable work has been done on understanding the Sasanian frontier in northeast Iran, most of the work has focused on its military function leaving a gap in our understanding of the economic, political and cultural frontiers that also existed in this region (Nokandeh et al. 2006; Omrani Rekavandi et al. 2007; Omrani Rekavandi et al. 2008; Sauer et al. 2013).

term ‘nomadic’, often applied in a generalist fashion to describe all forms of mobile pastoralism is misleading as it represents only one extreme (completely mobile and completely reliant on a pastoral economy).

Khazanov’s (1994 p.20–24) ‘basic forms’ of pastoral mobility (described below) include pastoral nomadism, semi-nomadic pastoralism, semi-sedentary pastoralism, herdsman husbandry, and sedentary animal husbandry. There concepts are widely used in archaeology and define types of mobile pastoralism based on a group’s economic reliance on herding. However, they do tend to characterise pastoral economies as undiversified, and thus reliant on interaction with sedentary communities. This has in turn influenced models of state formation of mobile pastoral societies emphasising dependency on neighbouring centralised states (e.g. Barfield 2001), though this view is being challenged by models that redefine definitions of state to acknowledge the complex systems that define nomadic polities (Honeychurch 2014). The descriptions of the following categories speak to the degree to which pastoralism forms the basis of a communities’ economy, however, in reality the distinction between such categories can be very subtle and the exploitation of numerous different resources should be emphasised (i.e. multi-resource nomadism - Salzman 1971).

Pure pastoral nomadism is characterised by an un-diversified economy. These communities are reliant on the products they produce, and exchange of these products with agricultural and urban communities to obtain goods they cannot produce themselves. True nomads, with a single resource economy, however, have been suggested by some to be a rare phenomenon (Salzman 1972).

Semi-nomadic pastoralists are also primarily reliant on their herds, but may supplement this strategy with some agriculture or other economic activity; or trade with sedentary communities to obtain goods they do not produce themselves. Semi-sedentary pastoralism tips the scales in favour of an economy more reliant on agriculture, however pastoral migrations are still important. Recognising the difference between semi-nomadic pastoralism and semi-sedentary pastoralism can be difficult; more important is the recognition of a reliance on both economic strategies in varying proportions, as distinct from pure pastoral nomadism.

In communities practicing herdsman husbandry, agriculture is the primary economic activity and the majority of the population is sedentary. Animal husbandry forms a secondary part of the economy and animals are moved to pastures and looked after by a few specialised herders. *Yaylag* pastoralism (from the Turkish name for this practice) is a variant of herdsman husbandry and is similar to the concept of transhumance where animals are moved between ecological zones on a seasonal basis.

Lastly, sedentary animal husbandry and its variations, namely 'household-stable animal husbandry' involve sedentary communities engaged primarily in agriculture who also have animals that are in certain seasons grazed near the settlement. This strategy still requires the movement of herds, but it is very much limited in its range.

Overarching categories, such as these, are commonly used, but have been criticised as too simplistic. They place too much emphasis on the predominance of pastoralism in multi-resource economic strategies involving mobility, and are often too broad to represent the dynamism and variability in pastoral strategies (Dyson-Hudson 1972; Forbes 1995 p.328; Frachetti 2008 p.372; Salzman 1971). Furthermore, terminologies tend to favour one variable such as the mobility of a group (the frequency of movement), its range, its degree of reliance on pastoralism or agriculture (Cribb 1991 p.16; Khazanov 1994 p.20–24; Wendrich and Barnard 2008). As Wendrich and Barnard (2008 p.7–9) have recently suggested, broad categories are useful as loose frameworks; for example, semi-nomadic pastoralism, semi-sedentary pastoralism, transhumance and sedentary animal husbandry can all be described as agropastoral strategies. However, we should focus less on labels and aim to provide more nuanced descriptions of specific circumstances that recognise the who, what, where, when and why of mobility. In general, I would argue that scholars should be encouraged to discuss the variability within whichever descriptive categories they utilise, relating them to the specific geographical, political, social and economic factors of a particular region, taking an approach not unlike that advocated in the previous sections for the study of empires and frontiers.

2.3.1 MOBILE PASTORALISTS AND THE WIDER WORLD

Many scholars have made the association between broad types of mobile pastoralism, their predominance in various geographical regions of the Old World, and the political and social integration of mobile pastoral groups with sedentary communities (Alizadeh 2010; Bacon 1954; Barfield 1990; Khazanov 1994 p.44–59; Lattimore 1962 p.487; Rowton 1974). This manifests as lesser levels of integration between mobile pastoral groups and sedentary communities in parts of Arabia and Central Asia with vast tracts of steppe or desert that can be utilised for grazing. This is contrasted with the a significantly higher level of integration of mobile pastoral groups within the sphere of rural and urban communities in most parts of Western Asia, primarily because of the comparative lack of large geographical areas only suited to grazing. This can result in mutually beneficially situations, or bring communities into conflict, and involves interactions between agriculturalists and pastoralists, and tribe and state (Banning 1986; Bates 1971; Haiman 1995; Pastner 1971; Rowton 1974).

> "…in contrast to the nomads of the Eurasian steppes, the nomads of the Middle East were in considerably closer, more permanent and more day to day contact with the sedentary population and states of the region, and that the interdependence between nomads and the sedentary world was greater here. From the geographical point of view, for the nomads of the Middle East the 'outside world' was not outside in the real sense of the word. On the one hand, their pastures and pastoral routes were usually within the territory of one state or another, if only purely nominally so; on the other hand, no complete spatial differentiation could be made between nomadic pastures and pastoral routes and sown fields" (Khazanov 1994 p.184).

Rowton's (1973; 1974) concept of "enclosed nomadism" describes a situation common to Western Asia in which 'nomadic' or mobile pastoral groups have strong links with sedentary communities both because of geography and range, and political structure. Enclosed nomadism involves more than just semi-nomadic pastoralists interacting with sedentary groups, but also includes what he describes as "integrated nomads"; those that are part of tribal groups that have both a pastoral nomadic segments, and sedentary segments, and non-integrated tribes that still have strong links to sedentary society.

He argues that these relationships are managed through a "dimorphic social and political structure" which involves the interaction between both tribe and state and nomad and sedentary. This type of structure characterises polities which both exert power over a town/ urban centre with tribal and non-tribal elements and mobile pastoral groups within the area. "In enclosed nomadism, seasonal migration leads into pastoral enclaves located within the sedentary zone or on its fringe. The result is close interaction between tribe and state, with the dimorphic chiefdom as an intermediate link" (Rowton 1974 p.22).

External nomadism, in contrast, describes mobile pastoral groups for who there was little need for the day to day sharing of territory and resources that characterise the interaction between mobile and sedentary groups in Western Asia; this is due to the very different geography of Central Asia (and some parts of Arabia) (Bacon 1954; Rowton 1974). This does not mean that interactions between the mobile pastoral groups of Central Asia and neighbouring centralised sedentary polities did not occur; these groups have a long history of raiding and trading with their sedentary neighbours. However, they had a diversified subsistence economy which did not tether them to their sedentary neighbours (Honeychurch 2013 p.289; Rogers 2012 p.216).

As such, political systems very different from the "dimorphic social and political structure" (Rowton 1974 p.22) described above emerged. The mobile pastoral polities that grew up in Central Asia, beginning in the mid-1st millennium BC have been called nomadic states or nomadic 'empires' (Barfield 2001; Goldstone and Haldon 2009 p.5–6; Honeychurch 2014; Rogers 2012). Their emergence has been linked to their interaction (through trade, extortion etc.) with territorial empires, and as such, these secondary or "shadow empires" rise and fall in sync with the centralised states they border (Barfield 2001). Recently, however, this model has been challenged; while nomadic polities engaged in raiding or trading with sedentary neighbours, they were not tethered to the ups and downs of centralised states (Rogers 2012 p.216–220). Multiple factors, both internal and external, are now seen to have contributed to state formation in this context (Di Cosmo 1999; Drompp 2005; Honeychurch 2014; Rogers 2012). While they do not fit the mould of the classic territorial empire, nomadic polities did exert considerable power over vast areas. Decentralised, perhaps because of high levels of mobility, their systems for maintaining power involved a combination of "kinship, political office, ideological appropriation, differential expertise of the participants, existing social categories, informal power arrangements, and coercive force" (Rogers 2012 p.213; see also Honeychurch 2014).

Criticisms of these models suggest that they suffer from an inability to explain change; they are static, and discuss subsistence strategies and socio-political systems at the macro scale, not taking into account the complex interaction between humans and "macroenvironments" (Marfoe 1979 p.10). Wendrich and Barnard (2008 p.6), also rightly point out that the concepts of 'enclosed' and 'external' nomadism have the sedentary community at its centre and mobile pastoralists as peripheral. They are different from categories such as pastoral nomadism and transhumance in that they denote "the relation between the settled and nomadic population rather than to a mobility pattern". Adapted from Rowton's concept of 'enclosed nomadism' Alizadeh (2010) has developed a model of 'enclosing nomadism', which he argues better explains early state development in southwest Iran. As juxtaposition to 'enclosed nomadism', this model places highland nomadic pastoral communities at its centre, and proposes that they had the ability to enclose urban and rural communities within their sphere.

This discussion about the integration (or lack of) of mobile pastoral and sedentary communities is relevant to our understanding of the social, political and economic landscape of the Gorgan Plain in antiquity. Sitting geographically at a contact point between the imperial sphere of successive Persian Empires, and the vast steppes of Central Asia, the potential for interaction between nomadic, agropastoral, and sedentary farming communities was high. However, as well as considering these potential interactions on the macro scale, we also need to consider them in the context of diverse local environmental subzones in which subsistence strategies overlapped.

2.3.2 MOBILE PASTORALISM IN NORTHEAST IRAN

Using the current archaeological evidence to infer the presence of nomadic or even semi-nomadic pastoralists in Iran's prehistory (Neolithic, Chalcolithic, Bronze Age) is still highly debated and in some cases roundly criticised (see Abdi 2003; Alizadeh 2010; Bernbeck 1992; Hole 1974; Khazanov 2009; Petrie 2013; Potts 2008; Potts 2014; Weeks et al. 2010; Wendrich and Barnard 2008 p.14). Prior to the mid-1st millennium BC, Potts (2008 p.206; 2014 p.420) argues that sedentary agricultural communities may have practiced transhumance, or other agropastoral strategies, but with only a few members of the community moving animals between pastures seasonally. Nomadism and semi-nomadic pastoralism are arguably a late development in the history of pastoral practices in ancient Eurasia, possibly emerging sometime in the late-2nd or 1st millennium BC in Iran linked with the domestication of the horse (Bacon 1954 p.51; Khazanov 2009 p.119; Potts 2014; Rowton 1974 p.4). This view is based on the lack of direct evidence for pastoral nomadism or semi-nomadism in the archaeological record (that cannot also be interpreted as transhumance, or sedentary animal husbandry). Textual references that refer to nomadic groups appear in the mid- to late-1st millennium BC in the works of Greek and Roman writers such as Herodotus, Strabo, Ptolemy, and Tacitus, and on Achaemenid inscriptions, though references to groups that may have been nomadic appear in Assyrian texts from around the 8th century BC (Ivantchik 2005; Potts 2014 p.88–118).

While exact locations are difficult to identify, several of these groups may have inhabited regions to the south or east of the Caspian Sea, and possibly further east in the Achaemenid and Parthian periods; these include the Daians (where the name for the region Dehistan may come from), Mardians, Derbikes, Cadusians, Tapyrians, and Apasiacans (Potts 2014 p.89–118). Even more solid are the references to the nomadic and semi-nomadic groups existing north of the Gorgan Plain by the Sasanian period such as the Chionites and Hephthalites. Accounts of their often antagonistic but politically complex interactions with the Sasanian Empire are discussed by various Roman, Armenian and later Islamic sources (e.g. Ammianus Marcellinus, Procopius, Lazar Parpeci, Elishe and al-Tabari (see chapter 1.3.5 for further discussion of the Chionites, Kidarites, Hephthalites and primary sources referring to them).

Clearly, by the mid-1st millennium BC we have identifiable nomadic groups and polities existing to the north of the Gorgan Plain. Equally, it is likely that sedentary communities living in the plain were engaged in both agricultural and pastoral activities (i.e. transhumance or sedentary animal husbandry). But how do these practices manifest in the archaeological record, if at all, and how do we interpret them?

2.3.3 EVIDENCE AND INTERPRETATION

According to the traditional view, mobile pastoral, and more specifically nomadic, and semi-nomadic groups, leave little or no trace in the archaeological record (Childe 1936 p.81; Finkelstein and Perevolotsky 1990 p.67–68). ‘Negative evidence’ is often used to argue for the presence of mobile pastoral groups, especially in prehistory (see Finkelstein and Perevolotsky 1990; Finkelstein 1992, and Rosen’s (1992) critique). However, this view has been criticised for allowing archaeologists to make assumptions based on little to no evidence (Cribb 1991 p.66; Potts 2014 p.41, 44). This includes assuming the presence of nomadic groups to explain a decline or disappearance of sedentary settlement, their arrival in a region to explain a dramatic shift in material culture, or their presence based on the existence of burials without associated settlement.

However, more sensitive survey methodologies, and the use of high resolution imagery for remote sensing have increased the number of features relating to mobile pastoral activities that have been recovered in the archaeological record in the last few decades (Alizadeh and Ur 2007; Cribb 1991; Frachetti and Maksudov 2014 p.199–200; Hammer 2014;

Harrower 2008; Hopper and Omrani Rekavandi in press; Kennedy 2014; Rosen 1992; Rosen 2003; Tucker 2009; Ur and Hammer 2009). The survival of these features, such as pens, enclosures, and encampments depends on the nature of the local environment, the activities associated with the socio-economic strategy of a group (degree of reliance on pastoralism or agriculture and associated range of mobility), subsequent use of the landscape, and geomorphological processes such as alluviation. In landscapes that have remained sub-optimal for agriculture over an extended period, or arid environments, the probability of features associated with mobile pastoralism surviving is higher. However, caution must be exercised when extrapolating a pattern of land use based on the exploitation of only one environmental zone (Wilkinson 2003 p.173). Equally, while these features can be found in the archaeological record, they are often difficult to date based on the surface archaeology (Hammer 2014 p.273; Ur and Hammer 2009 p.53). Because of the lower rate of survival for these features there are also problems in interpreting their function or understanding long-term processes of use and re-use (Hammer 2014 p.270).

For the groups who leave these features behind, it can be challenging to determine their place on the continuum of mobile pastoral strategies. For example, while cases have been made for interpreting several prehistoric sites as those of nomadic pastoralists, there has been just as many suggestions that these features in fact represent the activities of communities practicing mixed agro-pastoral strategies (i.e. village based herding or transhumance) (Abdi 2003; Alizadeh 2006 p.95–101; Bernbeck 1992; Hole 1974; Rosen 2003).

The material culture associated with an encampment or temporary site may give an indication of the mobility pattern, or reliance on pastoralism, of the group using it. The material culture of pastoral sites can reflect use, and even production of ceramics, indicating interaction and exchange with other local communities (Frachetti and Maksudov 2014 p.210–211). The range of material culture from a site, and its similarity to regional assemblages of sedentary communities can also indicate mobility patterns. Abdi (2003 p.406) for example has argued that a limited assemblage at a site (representing only activities related to herding), or similarities between the assemblage of a site and the wider regional assemblage could indicate that a site was used by people practicing transhumance as opposed to nomadic pastoralism. In modern mobile pastoral groups, it has been observed that material culture and its portability is linked to the particular group's strategy (Cribb 1991 p.78).

Careful excavation of sites such as encampments can help to understand the long-term history of mobile pastoralism in a local landscape (Frachetti et al. 2010; Frachetti and Maksudov 2014). Also, analysis of the faunal assemblages from sites can help to understand herd composition and subsistence strategies (Bocherens et al. 2001; Frachetti and Benecke 2009; Sasson 2010). Furthermore, strontium isotope analysis can help to understand the mobility of herd animals as a proxy for human mobility (Mashkour 2003). Finally, geoarchaeological analyses including the identification of animal pens, and animal diet through dung remains can also provide ways of understanding individual sites and features (Brochier et al. 1992; Shahack-Gross 2011; Shahack-Gross et al. 2008).

Using suitable methodologies and understanding the wider distribution of such features, and their context within a regional (or even local) pattern of settlement and land use, especially across different ecological zones is needed (Chang and Tourtellotte 1993 p.261; Hammer 2014 p.271; Wendrich and Barnard 2008 p.1). Factors such as the location of temporary sites, distance from permanent settlements or agricultural zones or even evidence of seasonal occupation over a considerable time could provide hints (Abdi 2003 p.406). An approach which looks at adaptations and variability in pastoral strategies in a local/regional context over the long term is needed (Frachetti 2008; Hammer 2014; Rosen 2008 p.132).

Ethnography, and ethnoarchaeology have also long been used in constructing models with which to interpret, or provide parallels for archaeological features related to pastoralism or for hypothesising about the socio-political organisation of mobile pastoralists in antiquity (Alizadeh 2003; Banning and Köhler-Rollefson 1986; Banning 1993; Bienkowski and van der Steen 2001; Chang and Tourtellotte 1993; Eldar et al. 1992; Rosen 1987; Saidel 2001; Saidel 2008). However, directly applying situations described in ethnographies to interpret archaeological patterns is anachronistic especially in relation to mobile pastoralism in prehistory, and its applicability is generally viewed critically. Some scholars have suggested the exercise of caution in the use of ethnographic analogy, with others calling for it to be thrown out entirely (Bernbeck 2008 p.46–47; Gilbert 1975; Halstead 1996 p.35; Khazanov 2009; Potts 2008 p.116–117; Wendrich and Barnard 2008 p.14). Clearly, the social, cultural and political context in which modern activities of mobile pastoral communities occurs are not going to be the same as those that occurred in the past, and there is the possibility that there is simply no recent analogous situation for the activities represented by the archaeological evidence. Arguments for the use of ethnographic analogy, however, emphasise that its value lies in generating possibilities for how people could have interacted with the local environment that can be tested against the archaeological record or in interpreting basic activities that are “timeless” such as food procurement (Alizadeh 2010 p.355; Bienkowski and van der Steen 2001 p.29; Chang and Koster 1986 p.133). Using geographically relevant ethnographies to understand land-use strategies or human-environment interaction can suggest possibilities for how a mobile pastoral community may have engaged with the local landscape, but it important to remember that they are always of their time and represent only known variations (Wendrich and Barnard 2008 p.14). Equally, socio-cultural factors are just as important in shaping human-environment interaction as the physical environment. Identifying material remains as analogous to ethnographic examples can exclude the possibility of practices that do not have direct analogies (Frachetti 2008 p.372–3). However, as Ravn (2011 p.722) points out we must be as much concerned with the differences between the archaeological and ethnographic records as with the similarities, and the relevance of both. By doing so we can produce useful models that can be proved or disproved as more evidence becomes available. In general, studying mobile pastoral groups in archaeology requires multi-faceted methodologies making use of a wide range of data, and analytical tools.

2.4 ARCHAEOLOGICAL LANDSCAPES OF URBAN, RURAL AND MOBILE PASTORAL COMMUNITIES ON THE GORGAN PLAIN

Landscape archaeology attempts to understand the development of the landscape through time, studying its use, reuse and reshaping by cultural forces, while recognising that it is not a static backdrop upon which anthropogenic forces acted, but a participant in the interaction between the natural and the cultural. The landscape both shapes and is shaped by human activity which imbues it with cultural, political, and religious significance (Anschuetz et al. 2001; Ashmore and Knapp 1999 p.2; Wilkinson 2003 p.3–4). Landscape archaeology can encompass the study of not only the ecological and environmental factors that precipitate change in human groups, but also the agents of change themselves and a host of other socio-cultural factors affecting human decision making and the relationship between human beings and the landscape. The landscape approach adopted in this study is very much oriented toward a regional scale of analysis, however, it also allows for movement between scales, from the supra-regional (e.g. imperial scale) down to the local (e.g. seasonal movements related to mobile pastoralism).

Sinopoli (1995 p.4–5) identified four interrelated issues that archaeologists and historians face when trying to study empire:

- the geographical and demographic scale of empires
- the amount of data available from multiple sources, and its lack of integration
- the diversity in social, cultural, political and religious systems, and finally
- the difficulty of seeing internal dynamics within an empire because we do not have fine enough chronological resolution

Wilkinson et al. (2005) have argued for the role of landscape archaeology (utilizing techniques such as regional survey, remote sensing and the use of GIS) in the study of empire that can help to tackle some of these problems; a landscape approach with its main focus on regional analysis can be utilised in conjunction with other lines of enquiry, such as the analysis of text to understand large-scale social, cultural, political and economic patterns that characterise empires. This can be supplemented by more focused studies of micro regions or sites to understand local developments in a more chronologically nuanced way that is not always detectable at the grand scale of empire.

As such, a landscape approach is important not only for understanding large-scale impacts of imperial investment on a landscape, but can also provide an important framework for studying mobile pastoralism. Diachronic studies of local systems indicate that pastoral landscapes are reflective of dynamic and adaptive practices responsible for and responsive to changes to the social and natural environment (Frachetti 2008 p.375; Frachetti et al. 2010 p.624; Hammer 2014). A landscape approach, especially utilising GIS based models can be utilised to develop models for site prediction to guide survey, and used to test possible relationships between nodes of pastoral activity and natural resources (Coppolillo 2000; Frachetti and Maksudov 2014; Hammer 2014).

In the context of the current study, a landscape approach to the study of the Gorgan Plain between the Late Iron Age and the Islamic period, will allow for interrelated research questions to be tackled at different scales. To do this, we can utilise the tools and techniques of landscape archaeology (field survey, remote sensing, GIS analysis) to unpack the complex palimpsest of features that have shaped the landscape of the Gorgan Plain as we see it today. This involves the analysis of hundreds of sites and features in an attempt to recognise groups of features that represent 'signature landscapes'. These signatures, as discussed in Chapter 1, can be used to build a narrative about changing land use strategies through time. These signatures are very much linked to their locations within either landscapes of preservation or destruction. Zones of survival and zones of destruction were terms first defined by Taylor (1972 p.109) in his study of settlement in pre-historic Britain. He argued that traces of settlement were more likely to survive in "zones of survival" that had not been resettled repeatedly over time, such as highlands. "Zones of destruction", on the other hand were often lowland areas, which contained the most productive agricultural land. This concept was adapted to the Near East by Wilkinson (2003 p.41–43). Deserts and mountains are generally zones of preservation, while landscapes which have seen almost continuous settlement over thousands of years are characterised as zones of attrition. Intermediate zones also exist (steppe, semi-arid zones, rain-fed agricultural zones) that fluctuate between the two categories depending on their settlement histories. In areas of long-term sedentary settlement generally only the most robust signatures survival. Meanwhile, in mountainous, desert or steppe regions, the likelihood of more ephemeral settlement or land use strategies, often associated with mobile pastoralism or temporary occupation, have a higher chance of survival (for examples of signature landscapes located in different zones and contexts (see Alizadeh and Ur 2007; Kennedy 2014; Tsvetsinskaya et al. 2002).

2.4.1 CONNECTIVITY AND FRONTIERS

How do we best conceptualise and represent the complex nature of changing connectivity in a landscape in which political and social affiliations were oriented and reoriented as the role of the region shifted from the local and regional, to the imperial? Current approaches to Near Eastern empires in archaeology highlight their diversity, and promote a diachronic approach in which long-term local and regional histories can contribute to our understanding of the complexity of relationships between imperial centres and surrounding regions including the continual renegotiation of power relationships (e.g. Glatz 2009; Khatchadourian 2013; Ristvet et al. 2011).

Nearly 30 years ago, Liverani (1988 p.85–86) questioned the use of the homogenous 'oil stain' model frequently used to depict the Assyrian empire. He suggested that the evidence instead pointed to the Assyrian Empire as collage consisting of Assyrian territory, tributary polities and non-Assyrian territory connected by networks facilitating communication and transport. This concept of empires, as networks was taken up by Monica Smith (2005), to critique the common tendency of portraying ancient empires in the style of modern states with clear cut boundaries and internal homogeneity arguing that these traditional cartographic representations create a visual dichotomy between “empire” and “other”. By extension this tendency also promotes the portrayal of what lies beyond ancient states as “turbulent (that is underexplored and unexplained) borderlands” (Smith and Rubinson 2003 p.2). This idea of a known/unknown dichotomy is also responsible for a view of cultural change that is uni-directional, moving from the centre to the peripheries (Lightfoot and Martinez 1995 p.471). Such representations are inadequate in portraying the complexity, and dynamism of ancient states - including changing physical and ideological frontiers, variable levels of control within different geographical areas, relationships and hierarchies between sites, and many other factors; instead, representing states through a series of nodes and connectors that serve to represent investment (or lack thereof) in sites, resources, and routes presents a more nuanced picture of ancient polities (Smith 2005). Smith’s (2007) ‘node-and-corridor model’, for instance, demonstrates a way to describe the growth of not just empires, but pre-modern states in general, that illustrates this uneven investment across a landscape generated by strategic interests in particular nodes, and the corridors that connect them.

Empires, like any human society can be understood as Mann (1986) suggested as intertwined networks of social power and as Glatz (2009 p.1) points out, allow us to view the “continuum of territorial and hegemonic domination” from the bottom up, and ultimately at different scales. In other disciplines, such as sociology and political science, the usefulness of understanding complex civilisations as networks and analysing them as such has been more predominant (Freeman 2004; Wilkinson 2002). Thinking and writing in terms of networks and connectivity have been common in archaeology for some time, and recent scholarship has focused on defining the components of these networks and expanding and testing the repertoire of network approaches (Knappett 2013 p.3–4). Network analyses are seeing increasing use in archaeology, especially in the study complex social systems like empires (Brughmans 2010; Brughmans et al. 2012; Knappett 2013; Scheidel 2014), though there remains much to be done in terms of establishing an archaeological method for network analysis (Brughmans 2010 p.303). Mapping these networks in a GIS has also resulted in interesting approximations of imperial growth and decline based on factors such as how quickly people and goods can move around the empire (e.g. Scheidel 2014). Such an analysis is beyond the scope of the current study, but conceptualising the Gorgan Plain in terms of connectivity at different scales that change through time (that is, using the idea of networks metaphorically rather than quantitatively), opens up new ways of thinking about socio-political organization (from the local and regional level to imperial hegemony) and the relationships between urban, rural and mobile pastoral communities.

Frontiers, composed of overlapping zones reflecting political, social, military, commercial and natural boundaries (see Elton 1996 p.4) are also regions of intensified cultural contact, such as between the Sasanian Empire and pastoral nomadic polities such as the Hephthalites (and through them traders and merchants from greater Central Asia) (Vaissière 2005 p.227–234). Depending upon the scale of analysis (either spatial or temporal) one can see the same agents conceiving of a single frontier in a multitude of ways. The presence of a linear barrier like the Gorgan Wall, represents a node of investment connected to resources and communities behind and beyond it. Far from being an impermeable physical barrier, the wall probably controlled and facilitated connectivity, along it and beyond it, as often as stopped it. That is, it managed the forms of, and the conditions under which, connectivity could take place resulting in a sort of managed interaction. As such, it can be envisaged much like rivers, which can be seen as facilitating movement as much as restricting it (Parker 2002 p.373).

For this thesis, the goal is to build on research into the political and military aspects of the north-eastern Sasanian frontier zone (see Sauer et al. 2013) with an exploration of its socio-cultural and economic dimensions both in space and time. As such, settlement and landscape feature location, morphology and periodization from the Late Iron Age through to the Islamic period will be considered so that medium and long term trends can be charted. These sites and features can be seen to represent nodes and connectors in a series of networks operating at different scales, and at different times, in the Gorgan Plain. The following chapter will discuss the methods that have been used to facilitate the collection and analysis of this data.

3 METHODOLOGY

In the previous chapter, the theoretical concepts that underpin this study were presented, including the usefulness of a landscape approach to the study of frontiers, complex ancient polities (e.g. empires), and mobile pastoral groups in the Gorgan Plain. In practical terms, this has mean the collation of a large amount of data on sites, water-management features, defensive infrastructure and features relating to agricultural and pastoral activities. This settlement data, gathered through field surveys and the remote sensing of satellite imagery has been integrated into a database in which each entry has a spatial extent that can be represented in a linked Geographical Information System (GIS)[7]. The database records can then be incorporated with other data and displayed in the GIS at the site, regional or supra-regional level. This can help us to visualise changes in settlement patterns, landscape intensification, subsistence practices and connectivity through time.

As with most archaeological data sets, it is very rare that we have the entire record preserved, and some settlement patterns are difficult to reconstruct through material evidence alone. For example, we may have better preservation in different environmental zones, or evidence representative of activities that leave a more visible imprint on the archaeological record (e.g. some agricultural vs. pastoral practices). Equally, combining multiple data sources that have employed different ceramic chronologies can often make it difficult to compare data at the fine resolution desired. As times, this means that only broad comparisons can be made and these agglomerations of time and events are often inadequate in representing the dynamic nature of any archaeological period. However, higher resolution 'windows' derived from better chronologically controlled data (i.e. from individual sites or local landscapes) can help.

This chapter discusses the preparation and interpretation of satellite imagery, provides an overview of the methodologies employed during data collection in the field, and will discuss the structure of the database, the data sources utilised, and problems with the integration of data from different surveys.

[7] In this study ESRI ArcGIS 9.3 – 10.2 software was used.

3.1 REMOTE SENSING AND SATELLITE IMAGERY

Remote sensing refers to techniques used to gather information by non-intrusive means. In archaeology this can include the use of aerial photographs and satellite imagery to detect sites and other cultural features (i.e. field systems, canals), and geophysical prospection techniques such as magnetometry to elucidate buried features without excavation. Both of these approaches were employed by the *GWP* with great success, and provided information on cultural activities at the regional and the site-specific scale respectively. Here, I will be discussing the application of the remote sensing of satellite imagery, types of imagery, the technical details of image preparation, and feature identification.

Prior to the use of satellite imagery, aerial photography was (and still is) a vital tool for the remote identification of archaeological features. Eric Schmidt (1940) pioneered its use in Iran in the early 20th century AD and, through his flights over many archaeologically rich regions (including the Gorgan Plain), producing many high quality images of important sites and cultural landscape features. Aerial photographs were also used as the base for the maps of the Gorgan Plain presented by M.Y. Kiani (1982b) in his publication on the Gorgan Wall and its associated settlement. Though the photographs themselves are not available for study today, several examples of aerial images appear in his monograph. These two examples demonstrated the potential for identifying cultural and natural features in the Gorgan region through non-invasive means.

In the last few decades remote sensing using both modern and historical imagery has become an important tool for Near Eastern archaeologists (see Alizadeh and Ur 2007; Casana 2014a; Casana and Cothren 2008; Challis and Howard 2006; Challis et al. 2004; Hritz 2014; Kennedy 1998; Kennedy 2014; Kennedy and Bishop 2011; Philip et al. 2002; Ur 2003; Ur 2010; Ur 2013; Wilkinson 2003 p.43–47; Wilkinson et al. 2013). Declassified CORONA and GAMBIT satellite imagery (released by the American government in 1996) has perhaps been one of the most useful for identifying archaeological sites and features and, as such, has been used extensively (Casana 2014a; Casana et al. 2012; Fowler 2013; Philip et al. 2002; Ur 2013). This imagery is of high enough resolution (3m or less) that individual archaeological sites can be identified. CORONA images also provide a window into the landscapes of the Middle East as they existed in the recent past. Since the images were taken in the 1960s and 1970s extensive damage has been caused by modernization and the intensification of agricultural programmes in many regions, including the Gorgan Plain (see Okazaki 1968).

Modern multispectral imagery such as Landsat, WorldView, Digital Globe and Quickbird are also useful for feature identification, and can be used to identify features through their different spectral signatures (e.g. Altaweel 2005; Menze and Ur 2007; Stone 2012). While some high resolution imagery remains expensive, a considerable amount is available to download or access on platforms such as Google Earth meaning that archaeologists now have access to an extensive free dataset (e.g. Kennedy and Bishop 2011). Furthermore, Digital Elevation Models (DEM) derived from ASTER and SRTM images have multiple uses, from creating topographic models to mapping surface water flow and ancient water systems (Harrower 2008; Harrower et al. 2012; Hritz and Wilkinson 2006; Wilkinson and Rayne 2010, Rayne 2015).

In summary, there are multiple types of imagery of varying dates and resolutions available to study landscape development in the Middle East. The use of multiple types of imagery can result in more robust site and feature identifications. Equally, remote sensing allows us to survey extensive areas that can be interpreted through targeted ground-truthing, which would not be achievable with the limited time and budgets of most field surveys.

In this thesis, CORONA imagery from the 1052 mission taken in 1969, orthorectified using Landsat 7 imagery and checked in the field using a handheld GPS has been used as the primary source for site identification. This has been supplemented by panchromatic and multispectral imagery from other sources, and SRTM elevation data. Below is an overview of the types of imagery that were utilized in this study. The details (including type, resolution, date etc. can be found in Table 3-1).

3.1.1 LANDSAT

Orthorectified[8] Landsat-7 imagery from 2000 and 2001 were used in this study. The images from the Landsat-7 satellite, launched in 1999, are multispectral. Each spectral band represents a different wavelength of energy reflected or emitted from the earth, that can be viewed in combination to detect different aspects of, or changes in, the environment

[8] The Landsat is processed by the USGS using the Level 1 Product Generation System (LPGS) and processed to Standard Terrain Correction (Level 1T- precision and terrain correction). For futher details see https://landsat.usgs.gov/Landsat_Processing_Details.php.

(https://landsat.gsfc.nasa.gov/data/). While Landsat 7 multispectral imagery is not sufficient for the detailed identification of archaeological sites, the panchromatic images (band 8), are of higher resolution (c. 15m instead of 30m), and were utilized as base maps for the orthorectification of CORONA and GAMBIT imagery (see below). The multispectral imagery (30 m resolution) was employed for identifying geomorphological features, and giving an overall impression of land use (i.e. modern settlements, agriculturally productive and well-watered areas) (see Fig. 3-1)

3.1.2 CORONA

The primary identification of archaeological features was done through an examination of the CORONA KH-4A images from the 1052 mission taken on 06 October 1969. The date of the images is important; from the mid-20th century AD, mechanised farming increased in use in the region (Okazaki 1968: 9) resulting in many alterations to the landscape. These images appear to predate many of these changes. The CORONA images are analogue photographs and had to be scanned and orthorectified in order to be used. The CORONA images were registered to the orthorectified Landsat imagery in ERDAS Imagine. Hundreds of evenly distributed Ground Control Points (GCPs) were applied to each frame and a polynomial model was utilized for their registration. The results were checked in the intial seasons by a handheld GPS in the field resulting in a margin of error of less than one Landsat pixel[9] (for complete overview of the image preparation see Wilkinson et al. 2013 p.42). The CORONA images for northeast Iran were rectified by Nikolaos Galiatsatos at Durham University.

The images of the Gorgan Plain study area that were utilised cover approximately 13000 km² including the Alborz Mountains and up to lower reaches of the Atrak (no analysis was undertaken on the landscapes to the south and east of the Alborz visible on the images) (Fig. 3-2). This imagery has been used extensively throughout the project to guide the landscape survey and aid in the development models of site morphology and landscape signatures in conjunction with ground based survey data. For the current study, each strip of CORONA (within the study area) was systematically viewed and all potential

[9] This assumes that the handheld GPS is error-free (Wilkinson et al. 2013: 43). In reality, the margin of error in the GPS varied. As such, in general, the difference between a location on the imagery and the same location on the ground was in the region of c. 30-50 m.

archaeological sites were evaluated and digitised in a GIS. Fig. 3-3 illustrates the kinds of features visible on a CORONA image.

Once orthorectified each CORONA image was examined systematically and all potential archaeological features (sites, canals, routes) were digitized, alongside selected natural features in a GIS (ESRI ArcMap 9.3 to 10.2). The initial mapping and identification of sites was undertaken by Nikolaos Galiatsatos for a 10 km wide corridor along the length of the Gorgan Wall (c. 5 km on either side of the wall, and c. 10% of the total area within the study area covered by the imagery). The work for this thesis extended the mapping and feature identification to the entirety of the area between the foothills of the Alborz and the lower reaches of the Atrak River, which were covered by the CORONA images (few sites or features could be discerned within the Alborz Mountains). An overview of the main types of features identified on the CORONA Imagery and their interpretation is discussed below (see also Table 3-2). A image of each site from the database that was visible on the CORONA imagery is presented in Appendix B.

3.1.2.1 THE GORGAN WALL AND ASSOCIATED FORTS

The Gorgan Wall is clearly identifiable on the CORONA images. From approximately twelve kilometres inland from the shore of the Caspian Sea, and stretching almost 200 km towards the east, the wall appears as a relatively straight light-coloured line with a dark border on its northern side (Fig. 3-3). The dark border represents the wall ditch (Wilkinson et al. 2013 p.69). Lighter coloured upcast is also visible to the north of the ditch and the south of the wall. Rectilinear forts appear at frequent intervals along the south side of the wall (Fig. 3-4). There are 32 forts that have been confirmed on CORONA imagery and in the field by the *GWS* (see Wilkinson et al. 2013: Table 3:4), while a further fours forts were identified along the eastern extension of the wall by our Iranian colleagues and visited by members of the *GWS* team (Wilkinson et al. 2013: 65 and Fig. 3:42). Those visible on the CORONA imagery are marked by light borders, which are in turn surrounded by a darker coloured ditch. Many have internal features representing roads, ditches or barrack blocks. Barrack blocks are visible on CORONA and imagery from Google Earth in at least fourteen forts, with possible examples in a half a dozen more. These barrack blocks were confirmed at some of the forts through field visits, magnetometer survey and excavation (Sauer et al. 2013 p.232, Table 6:8).

Twelve of the forts also had anomalies (mounding and/or soil discolouration) surrounding them on the imagery. These were interpreted as possible extramural settlements (Fig. 3-5). These anomalies surrounding the forts were visited in the field, and four of them were confirmed as having visible mounding, soil discolouration, pottery and/brick fragments, representing extramural settlements while the rest remained ambiguous (see Wilkinson et al. 2013 p.82, Table 3:4). As comparison, extramural settlements, or *vici*, have been located through excavation and geophysical prospection around a number of the Roman forts on Hadrian's Wall in northern England (e.g. Biggins and Taylor 2004 at Birdoswald; see Bidwell and Hodgson 2009 for an overview). Furthermore, extramural settlements were also a common feature surrounding Roman military camps and fortresses throughout the empire, developing to supply the needs of the soldiers (Hanel 2007 p. 410–413).

3.1.2.2 ARCHAEOLOGICAL SITES

The signature of archaeological sites on CORONA imagery can take several forms. Mounded sites (tappehs or tells) because of their height in relation to the surrounding plain often cast shadows. Equally, flat sites, or sites that have been ploughed out by agricultural practices often show up as a discolouration of the soil (Altaweel 2005 p.160; Fowler and Fowler 2005 p.257). A rough classification of site types was developed by the GWP from the results of the landscape survey (Wilkinson et al. 2013 p.43–46). All of the site types located in the field survey (excepting the low elevation sites defined by nothing more than a scatter of artefacts) were also distinguishable on the CORONA satellite imagery. These categories, descriptions and their appearance on the CORONA images are summarized in Table 3-3.

3.1.2.3 POSSIBLE TUMULI OR BURIAL MOUNDS

Clusters of small, mounded features, typically between seven and 20 m in diameter, are visible on the imagery in the steppe region to the north of the Gorgan River (Fig. 3-6). These features are much smaller than tappehs, and do not cast much of shadow. However, they appear lighter than their immediate surroundings perhaps due to their height, or the materials they have been constructed with. While these features have not been visited by the *GWP* or *PNP* surveys due to time constraints during the 2009 field season, Arne (1945 p.19–20) records the presence of similar small mounds to the south of the Gorgan River in his survey undertaken in the 1930s. He interprets these features as tumuli or cenotaphs, based on information from local Turkmen groups. Despite a relatively accurate map of their location, none of the tumuli identified by Arne are visible on the CORONA. This is likely an issue of preservation in the agricultural southern portion of the plain.

3.1.2.4 HOLLOW WAYS

Hollow ways as defined by Wilkinson (1994), are depressed linear features that represent ancient roads, tracks or droveways radiating out from a site. Ur's (2003: 106) study of hollow ways around Bronze Age sites in Syria has demonstrated that on CORONA images:

> "[M]ost hollow ways have a distinctive signature which can be easily distinguished from modern roads and natural wadi courses. The moist soils in the trough are less reflective, producing a broad dark line on the image. The edges of the hollow way slope down from the surrounding land surface to the trough. This increased gradient (relative to the flatter surrounding surface) promotes drainage and thus light reflectance; therefore the dark trough of the hollow way often has two light margins on either side of it. In some cases, these margins are absent".

Extensive examples have been mapped on CORONA satellite images from across the Middle East, but especially in Northern Mesopotamia (Casana 2013; Ur 2003; Ur 2010; Wilkinson 2003). While hollow ways can channel water like wadis, they are distinguished from the later by their linearity; wadis are often more sinuous (Ur 2010 p.80). The identification of these features can prove difficult however depending on image quality, or season (Altaweel 2005 p.153). Equally, canals that lack distinctive upcast banks (see below) can be mistaken for hollow ways.

In Northern Mesopotamia, these features generally have a depth of between 0.5 to 2m (Wilkinson 2003); Ur (2010 p.84 and Fig. 5.26) provides an example of a hollow way of c. 1.2m deep. However, most of the hollow ways he mapped ranged from 0.2 to 0.8m deep. The width of hollow ways varies as well, but many fall between 30-100m wide, with fewer examples of up to 200m (Ur 2010 p.77).

The majority of hollow ways visible on the CORONA images of the Gorgan Plain are concentrated immediately to the north of the Gorgan River in the eastern plain where more than 100 hollow ways and possible hollow ways have been identified measuring in length between c. 75m and nearly four kilometres. They exhibit the distinct signature referred to above resembling dark lines, some with lighter margins on one or both sides (Fig. 3-7). This area was not extensively irrigated in the past, and would likely have relied on rain-fed agriculture, making it a landscape of preservation relative to areas south of the river providing optimal conditions for the preservation of hollow ways. While hollow ways appear to be more common in dry farming zones such as in the Jazira, they have also more recently been noted in other environmental zones; this suggests that they are not the exclusive product of specific environmental conditions and may instead reflect specific pastoral practices that involve the frequent movement of large herds beyond the limits of agricultural fields (Casana 2013). The formation processes and dating of the Gorgan Plain hollow ways will be discussed in greater detail in chapter 6.

3.1.2.5 HYDRAULIC AND WATER CONTROL FEATURES

The Gorgan River is very dynamic; evidence for both partial and complete avulsions are found in the numerous palaeochannels visible on the CORONA images (Fig. 3-8). Based on the observation of these palaeochannels and relict meanders on the imagery and in the field, Wilkinson et al. (2013 p.29–32) have characterized several broad stages of development of the Gorgan River important to our understanding of the use of past water resources (see Table 6-8). The modern Gorgan River is represented by a consistent dark grey sinuous line. Palaeochannels appear less deeply incised than the current river course and are far less consistent in colour. At times they appear as narrow dark sinuous lines, sometimes with a white border. However, unlike the active river channel, they fade in and out across the landscape. Loops coming off from the modern Gorgan River, similar in signature to the palaeochannels, represent meander scars. They are often darker in colour than the active river channel and also appear to be wider and less distinct. Similar features have been noted on CORONA imagery in other parts of the Middle East (Challis et al. 2004 p.144–146). Inspection of the CORONA imagery and the historical and modern imagery available on Google Earth indicate that the course of the river has remained relatively stable between the 1960s and the present day.

Water control systems have also been employed on the plain for millennia. Canals often show up as linear features with distinctive lighter coloured borders (Fig. 3-9). These borders are the result of upcast from construction or the removal of silt from the maintenance of the canal (Altaweel 2005 p.158; Wilkinson 2003 p.45–52). While in description canals appear to resemble hollow ways, the upcast banks of the canal are often more clearly defined. Equally the location of both canals and hollow ways in relation to sites is important. In the case of the Gorgan Plain, hollow ways tend to radiate out from mounded sites, gradually getting narrower, and fade out c. 1-4 km from the sites; the canals that have been located are generally consistent in width from beginning to end, and sometimes can be linked to an ancient or modern river channel.

Qanat irrigation systems are also detectable on the Gorgan Plain (Fig. 3-10). A qanat, as it is understood in the context of the examples found in Gorgan, is a gently sloping tunnel with its upslope end sunk into an aquifer. From the 'mother well' at the upslope end, water drains along the tunnel to the surface at the downslope end, often leading to a village or fields (English 1998: 188; Lightfoot 2000: 215). The tunnel or gallery is dug in sections. Vertical access shafts are dug and then connected under the surface. The shafts are spaced roughly between 20 - 200 m apart, in Iranian examples, and provide access and oxygen for the workers (Semsar Yazdi and Labbaf Kaneiki 2010: 12). Equally the shafts provide access for maintenance (removal of silt etc.). The spoil from the digging of these shafts and subsequent cleaning out creates a ring of upcast around the mouth of the shaft. This upcast is often visible on aerial photos and high resolution satellite imagery. However, in some environments, qanats are cut directly into limestone (e.g. some parts of Syria) and have no distinct upcast mounds resulting in them being difficult to spot on imagery (Wilkinson and Rayne 2010 p.125).

Luckily, the access shafts for the qanats on the Gorgan Plain have been dug into the abundant loess soils resulting in upcast mounds around the access shafts. Qanats therefore appear as lines of white dots, spaced c. 20 – 50 m apart, generally extending from the foothills of the Alborz Mountains along alluvial fans into the plain. They vary in length from a few hundred metres to several kilometres in length.

3.1.2.6 AGRICULTURAL FEATURES

Ancient field systems, or more specifically their boundaries, are also visible on the CORONA imagery (Fig. 3-11). How fields are bounded (walls, terraces, informal soil boundaries etc.) and the geometry used to lay them out varies with time and place across the Near East (Wilkinson 2003 p.52–53). In the western steppe of the Gorgan Plain, several examples of what appear to be rectilinear field systems can be found. An examination of soil sections near these systems suggests that "the apparent field patterns appear to have been delineated by patterns of salt efflorescences, although as a result of recent ploughing these are not apparent today" (Wilkinson et al. 2013 p.57). This type of ancient field system can be distinguished from its modern equivalent on the CORONA images in several ways; they are fainter, on a different alignment, and divided up into much smaller rectilinear parcels. We can also assume their pre-modern date when they are cut or otherwise overlain by datable features also of some antiquity. Furthermore, many of the examples evident on the CORONA imagery were ploughed out of existence by the time the images available on Google Earth were taken in the early 2000s suggesting they were not in recent use.

Terraced field systems are visible in the Alborz foothills near the eastern end of the Gorgan wall. Terraces take advantage of slope and run off (Fig. 3-12). Following the contours of the slope, the edges of each terrace wall or "riser" appear as a roughly parallel set of light lines, each with a darker shadow on its downslope side. These are likely best characterized as contour terraces (Wilkinson 2003 p.55). Some are much more distinct than others perhaps indicating more recent use. Smaller field parcels are also evident within the levels of certain terraces.

There are a wide range of features that can clearly be seen on the CORONA imagery, including archaeological sites, defensive infrastructure (e.g. walls), water management features (canals, qanats), field systems, and natural features such as relict river systems. The recognition of particular features in specific environmental zones, and their relationship with one another contribute to our understanding of different signature landscapes which wil be discussed in detail in chapters 6 and 7.

3.1.3 GAMBIT

The coverage of the higher resolution Gambit imagery (also declassified spy satellite imagery) was limited to c. 1000 km² 'window' along the Eastern shores of the Caspian Sea. This area was also covered by CORONA imagery, however the GAMBIT imagery while of a similar date (1966) was of higher resolution (less than 1m) (Fig.3-13). GAMBIT images, because of their increased resolution over CORONA, have proved useful in studying Cold War era features in the former Soviet Union, of which many of these images were taken (Fowler 2008). In the present study the GAMBIT image was orthorectified by myself in the same manner as the CORONA (see above).

3.1.3.1 FEATURE IDENTIFICATION AND INTERPRETATION FROM GAMBIT IMAGERY

Due to its higher resolution, the GAMBIT imagery revealed a number of distinct, but ephemeral, features barely visible, or not at all visible on the CORONA imagery. These included what appeared to be enclosures or corrals, clusters of small circular depressions, and other features, with no direct parallels. A summary of the features located on the GAMBIT imagery is presented in Table 3-4 in which four main types of feature have been defined. These are:

a) circular or sub-circular enclosures
b) small circular and sub-circular features (with several sub-categories)
c) rectilinear features
d) irregular features

The features defined as circular enclosures (type a) measure between ~13 and 332 m in diameter. Their perimeters are defined by a lighter (than the surrounding soil) 'dashed' (i.e. segmented) line. There is no obvious difference in the soil colour inside and outside of the features. These features are all located within an area of c. 65 km^2 area beginning c. 8 km north of the modern town of Gomishan (Fig. 3-14).

The small circular features (type b) have been differentiated into sub-groups not only by their size, and signature on the imagery, but also their location. Group 1 are represented by circular/sub-circular features, relatively uniform in size (c. 5-10 m in diameter), that occur in line or clusters in quantities of between two and fourteen. These features are located in the same area as the larger circular enclosures (type a). Together, with the circular enclosures, group 1 of the small circular features may be associated with the activities of mobile pastoral groups on the plain, such as encampments, or animal pens. These features are an important element of a signature landscape representing the exploitation of this particular marginal landscape by mobile pastoral communities. The dating of these features to the last few hundred years is suggested based on their relationship with relict shorelines of the Caspian Sea, and historical accounts of land use in this specific environmental zone from the 18^{th} and 19^{th} century AD. The interpretation of these features and a more detailed discussion of this signature landscape can be found in Hopper and Omrani Rekavandi (in press).

The group 2 of small circular features include clusters of small circular/sub-circular features (each feature measuring c. 5-10 m in diameter) located near the settlement of Adzhjyab in Turkmenistan. Group 3 of the small circular features includes a cluster of circular/sub-circular features (c. 10 m in diameter) arranged in semi-circular fashion on a ridgeline approximately 7.5 km further to the northeast. The signature of groups 2 and 3 are clearly different from that of group 1 (see Table 3-4); at present their function is unclear. However, in the case of group 2, they are found not only in the vicinity of a modern settlement, but in close proximity to a group of irregular features (type d) that may have to do with modern building activities or even Soviet-era military activities. As these features were outside of the study area defined for this thesis, they have not been investigated in further detail.

The last feature-type defined from the imagery are rectilinear features (type c). These features vary in size and signature, and are distributed throughout the area of the imagery. While a number are clustered around the ruins of Gomish Tappeh, and likely relate to activity at that site, other examples are usually found in isolated and are widely distributed. Like the category 2 and 3 circular features, and the irregular features, further analysis is required to elucidate their function.

3.1.4 IMAGERY AVAILABLE ON GOOGLE EARTH

Several types of modern high resolution imagery are freely available to view on Google Earth with resolutions of approximately 0.5m. The type of imagery available depends on the region viewed, but includes QuickBird, Worldview-1, Worldview-2, Geo-Eye-1, SPOT and Digital Globe imagery taken between 2003-2016. This imagery was not used systematically, but in specific cases for two purposes: first, to check whether anomalies identified on the CORONA and GAMBIT images could be more clearly seen on other imagery; second, it was used to establish the extent to which certain sites and features have been changed or destroyed since the historical images were taken in the 1960s and 70s (Fig. 3-15).

3.1.5 SRTM

SRTM (Shuttle Radar Topography Mission) imagery from 2000 was utilized to create a Digital Elevation Model (DEM). The SRTM DEM has a resolution 90m (3 arc-seconds or 1/1200th of a degree of latitude and longitude), and is a useful source of height data for the region (Fig. 3-16). More detailed (higher resolution) DEMs of individual sites were achieved through small-scale topographic survey employing a total station (Fig. 3-17)

3.2 FIELD SURVEY

3.2.1 LANDSCAPE SURVEY

The landscape survey (see Wilkinson et al. 2013) was conducted over five seasons. The initial objective was to look at all identifiable landscape features (including sites, water control systems, etc.) within the immediate vicinity of the Gorgan Wall (initially within a 5 km buffer zone). This remit however, changed as the project developed, and the area under consideration was expanded to include the hinterlands on both sides of the Gorgan Wall. In doing so, it was hoped that a greater context for the wall, and associated forts could be established through the identification of earlier, contemporary and later settlement patterns.

CORONA satellite imagery was obtained at the beginning of the project, to enable the maximum number of potential sites to be identified prior to field-work. The initial landscape survey was conducted by T.J. Wilkinson, Hamid Omrani Rekavandi and Koroush Rostaei in 2005 - 2007. It was guided by the identification of potential archaeological features on the CORONA imagery that may have been related to the construction and use of the Gorgan Wall.

In the last season of the project (2009), I (along with project colleagues) extended the programme of site visits based on the identification of further sites on the CORONA imagery. This survey, guided by satellite imagery, also relied on the local knowledge of the Iranian archaeologists. As by this time, the dating of the wall, several forts and the distinctive settlement at Qelich Qoineq (GWS_16) had been established through radiometric analysis, two new avenues of investigation were added to the landscape survey. The first, was to visit, map the extent of and collect a ceramic sample from as many of the rectilinear sites similar to Qal'eh Kharabeh (GWS_1) and Fort 4 (FORT_8) (both Sasanian – 4th – 6th centuries AD), that had either been mentioned by Kiani (1982b), or observed on the imagery. The majority of these sites appeared to lie south of the Gorgan Wall. Second, our goal was to visit as many of the sites identified on the imagery that were morphologically similar to Qelich Qoineq (GWS_16) (8th- 5th centuries BC). It was suspected based on site visits to a small sample of these sites in earlier seasons that the majority of these 'qal'eh and outer town' type sites dated to sometime between the late Iron Age and the end of the Parthian period. This was important for clarifying settlement patterns on the plain between the mid-1st millennium BC and the Sasanian period. It was hoped that the expansion of the survey into the hinterland of the wall would allow us to fill in the gaps in our chronology and attempt to look at the long-term settlement history of the Gorgan region.

For each of the sites visited a *GWS* (Gorgan Wall Survey) number was allocated, a grab sample was made and the following information was recorded: location in UTM coordinates using a handheld GPS, dimensions of the site, geomorphology and topography, a description of the site, any subdivisions, a preliminary assessment of pottery types and dates, if samples were taken, who the site was surveyed by and when (for further description of survey methodology employed in the project see Wilkinson et al. 2013 p.40). In regards to the ceramic collection, no systematic survey was carried out; the surface area of the site was traversed and a sample of the range of diagnostic forms, and fabrics were collected. This allowed for us to state presence/absence of particular ceramic wares and forms visible on the surface. Ceramics collected at sites in the 2005 to 2007 (and first half of the 2009) seasons were also reassessed in the laboratory by our pottery expert, Seth Priestman, providing a more accurate chronological assessment.

After 2009, we were unable to continue fieldwork in Iran for several years. In 2014 and 2015 part of the team was again able to resume fieldwork in the region, and targeted survey was restarted guided by data and questions generated by this research described in this thesis. The results of these last two seasons of fieldwork, however, including a study of the sites identified and the survey pottery, have not yet been fully analysed. As the results of this work will be published in the near future with our Iranian colleagues, they have not been used in the current study.

3.2.2 SITE-BASED SURVEY

At the site level other methods were employed to gather a more detailed picture of settlement layout. While the following techniques were applied to several sites within the greater project, here I focus on the surveys conducted on the site of Qelich Qoineq (GWS_16). This site, located north of the Gorgan River, was subject to excavation and has been absolutely dated to the Iron III period (c. 8th - 5th century BC) and potentially represents rapid expansion into the steppe zone prior to the Sasanian period (Sauer et al.

2013 p.407–422). Therefore, more detailed surveys of the site were undertaken to better understand its layout. This included a topographic and geophysical survey (Fig. 3-17).

The topographic survey at Qelich Qoineq (GWS_16) was undertaken using a Trimble 3305DR Total Station by James Ratcliffe, Stephen Usher-Wilson and myself. An area covering 13.5 ha was surveyed in the northwest portion of the site. This included the area under excavation. In order to gain context for the trench and the overall layout of the site, the survey area extended from the central qal'eh to the edge of the site where a raised feature indicated the presence of ramparts. Measurements were taken every five metres resulting in a topographic map of relatively high resolution. The data collected was then processed using ArcGIS to create a contour map and digital elevation model. As the coordinates of the corners of the grid were taken using a handheld GPS unit (Garmin), the resulting images were georeferenced to the satellite image using these control points, taking into account the error in the readings (c. 5m)

A magnetometer survey was also carried out at the site of Qelich Qoineq (GWS_16) in the 2008 season (see Fig. 3.17). The survey was carried out under the direction of Roger Ainslie of Abingdon Geophysics, and Mohammed Ershadi and Stephen Usher-Wilson of the Gorgan Wall Project. Thirty by thirty metre grids were laid out across the site using a total station and the survey was carried out within these grids in one metre transects (Ainslie 2008; Sauer et al. 2013 p.408–411). UTM coordinates were recorded for the corners of the survey area. The resultant images were then georeferenced in a GIS and made comparable to the CORONA satellite imagery, and the results of the topographic survey.

3.3 THE DATABASE

3.3.1 DATA SOURCES AND MANAGEMENT

The Gorgan Plain database is built upon data from a variety of archaeological surveys of different dates, resolutions, methods and geographical coverage including published surveys conducted by other teams, and the data collected by the *GWP* discussed above. The main data sources, their dates, methodologies and coverage are listed in Table 3-5.

For the previously published surveys, maps of site locations were georeferenced to the CORONA imagery, and correlations between sites of different surveys were made based on location, site descriptions, site names, and sketch maps of individual sites. Ambiguities were noted, and at times, it was not possible to confidently correlate sites between surveys or with a site viewed on the CORONA image. These instances were noted, along with possible associations.

The database developed for the Homs Regional Survey project by Graham Philip and Anthony Beck, and adapted by Rob Dunford, Graham Philip, Dan Lawrence and Jennie Bradbury for the Fragile Crescent Project (see Lawrence 2012; Lawrence et al. 2012) was used as a model for the Gorgan Plain database. Sites and features are recorded as a spatial entity in a GIS (ESRI ArcGIS), while observations about various aspects of those sites are stored in a database run by Microsoft Access (Fig. 3-18). For each site a unique 'major ID' is assigned in the GIS. This same major ID is then given to each observation about that site in the database. The highest level of observation about a site is recorded as X_0_0, which acts as a parent ID. If a site has been recorded as having different spatial extents in different surveys, then each spatial extent of that site is assigned a Major ID which falls below the parent ID. For example, if site GWS_1_0_0 has assigned a different spatial extent by Survey A than it was by Survey B, all observations about the spatial extent of the site from Survey A would be classed as GWS_1_1_0, while all observations about the spatial extent of the site from survey B would be classed as GWS_1_2_0 and so on. If there are further subdivisions within those spatial extents, then these are assigned a major ID at the level beneath the parent observation (i.e. GWS_1_1_1 or GWS_1_1_2 and so on). In this way, multiple spatial extents from multiple data sources can be directly linked together in the database. As well as recording information on site locations, types, features etc., the spatial reliability of each dataset was also evaluated, as well as the archaeological significance of each site (See Appendix A for lists of the types of information stored). The database entries for all sites are presented in Appendix C in alphabetical order by prefix (e.g. ARNE, GWS, KIA etc.) and numerical order by Parent_ID (e.g. ARNE_1_0_0, ARNE_2_0_0).

In most cases, the database parent ID is used to refer to a site. As such, for ease of reading I will use an abbreviated format when referring to the database parent ID (e.g. GWS_1 instead of GWS_1_0_0). Referring to sites by their name has generally been avoided as multiple names have been given to the same site by different surveys. The only exception is when referring to specific Gorgan Wall Survey (henceforth *GWS*) sites (including forts), which will be referred to by their original *GWS* name and their database IDS given in brackets.

3.3.2 TYPES OF OBSERVATIONS

The database is structured so that observations are recorded by Category (i.e. Current Landuse, Geology, Site Feature), then further described by Data Type. Only certain categories are allowed, and within those, only specific Data Types are allowed. The other mandatory data field is Data Source. If an observation is made about periodization, Period Code, is also required. Table 3-6 provides an example of the types of observations that could be recorded for a given site. Optional information such as details about the data type, observation comments, and numerical data can also be recorded. A full list of the categories and data types can be found in the Appendix.

3.3.2.1 SITE CERTAINTY

The survey data entered into the database was also assessed in terms of its reliability, or site certainty (see Lawrence 2012; Lawrence et al. 2012). Three observations were made about the site certainty of each site from each data source. These are ‘archaeological significance’, ‘boundary certainty’, and ‘geographical precision’. A cumulative ‘overall site certainty’ was then assigned. ‘Archaeological significance’ is quite clearly defined from field derived data (though were ambiguous this is noted in the database), however, it is at times less clear for features located on imagery. ‘Archaeological significance’ of imagery derived data is therefore classed as high, medium, low or negligible as detailed in Table 3-7. Of course, in combination with field-based data, many of the sites on the imagery can be defined as definite. ‘Boundary certainty’, or the extent to which we are certain about the spatial extent of a site, was assessed for both data derived from imagery and data derived from field survey. ‘Boundary certainty’ can be classed as definite, high, medium, low, or negligible from field derived data, and high, medium, low or negligible from imagery derived data. The criteria for each classification is detailed in Table 3-8. ‘Geographical Precision’, or degree to which the location of a site has been accurately recorded was assigned to both field derived and imagery derived data as detailed in Table 3-9.

3.3.3 DATA QUALITY AND SITE CERTAINTY FOR INDIVIDUAL SURVEYS

Overall, site certainty is the easiest to assess for the field data collected by the *GWP*. Multiple GPS points were recorded for each site resulting in high or definite levels of boundary certainty or geographical precision. Each site identified by remote sensing of the CORONA imagery was assessed by each of these four criteria resulting in varying levels of site certainty for each site.

How this system of 'site certainty' assessment was applied to the data from the published surveys utilised in the database is discussed in detail below. Issues were encountered when dealing with less than perfect spatial data, and strategies had to be developed to make the data from multiple surveys comparable.

In total ten categories (resulting from various combinations of boundary certainty and geographical precisions) were defined. These combinations are presented in Table 3-10, and used in Tables 3-11, 3-13 and 3-14.

3.3.3.1 ARCHAEOLOGICAL MAP OF THE TURKOMAN STEPPE - THE SWEDISH SURVEY OF 1932-33 (ARNE 1945)

The survey conducted by T.J. Arne (1945) and his team in the 1930s produced an overall site map with a corresponding survey gazetteer that includes site names, dimensions, and pottery counts (Fig. 1-4). In addition, a diagram of the site morphology for 160 of the surveyed sites all plotted at the same scale was also produced (Fig. 1-5). This diagram illustrates the plan and section of each site, and indicates the highest point on each site. However, the site orientations as given on the diagram are not wholly accurate when compared to the orientation of the sites on the CORONA imagery and in the field.

Notably, this survey employed a trained surveyor making it unusually accurate for its time. Rectifying Arne's map to the imagery therefore resulted in a relatively accurate association between Arne's surveyed sites and the corresponding sites visible on the CORONA imagery, sites surveyed by our team in the field, and sites recorded by other surveys. However, depending upon the site, there is a difference of up to one kilometre between locations on Arne's map and the location of the same site on satellite imagery. Furthermore, there are several sites recorded by Arne which were not recorded in the field by the *GWS*, and/or are not visible on the CORONA imagery. In order to avoid any false site associations (simply associating a site from Arne's map with the closest *GWS*/CORONA site), site morphology, descriptions and dimensions from both sources were compared. If ambiguities still remained, other sources were consulted – i.e. if a site is located in a modern village, the village name was checked and compared to Arne's site name. If there was no solid candidate for one of Arne's sites based on the available information, no association between it and another site was made in the database, however, possible relationships were noted. In this way, double counting of sites has hopefully been kept to a minimum.

As a result of the evidence available, an assessment of the boundary certainty, and geographical precision can be made for each site recorded. However, to do so would be a very repetitive exercise as these interpretations would be the same for a great many of the sites. As such, all sites recorded fall into one of three groupings:

- Sites that are located on the overall site map as a point, and have a scale plan, (most also have dimensions indicated in the site catalogue)
- Sites that are only indicated on the overall site map as a point, and have dimensions indicated in the site catalogue;
- Sites that are only recorded as a point on the overall site map with no scale diagram, site description or dimensions **OR** sites that are not located on the map, but their location is mentioned in relation to other sites in the catalogue (i.e. in the vicinity of Site X or 200m to the east of Site X), or sites that are mentioned in the catalogue but are not located on the map.

The assessments for these three groupings are presented in Table 3-11. In this case, the geographical precision was consistently low, and the categories were differentiated by differences in the boundary certainty. Estimations of location had to also be made for sites that were not located on the maps, but mentioned in the text in relation to mapped sites. If for instance, it is stated that Site A is 150m E of Site B, then a point was placed in the named location. However, a buffer of 500m was placed around the point to represent the spatial uncertainty. If there was no distance indicated between Sites A and B, then a buffer of 500m was applied around Site B to represent the possible spatial location of Site A (see Table 3-12).

There are also several sites in the site catalogue for which there is no corresponding label on the overall sites map. These sites are 157. *Agh Meše*, 158. *Qala*, 177. *Qoša tepeler*, and 186. *Qarinyarik*. In order to create a spatial unit for these sites, I took the locations of the sites both before and after it (up to 5 in each direction) in the numeric sequence of the survey catalogue that were in the same general location, created a polygon, and established its centroid. A buffer of 10 km was then created based on this centroid. It seems more than reasonable that the site is located within this 10 km buffer zone.

3.3.3.2 HIROSHIMA UNIVERSITY SCIENTIFIC EXPEDITION TO IRAN: 1976 AND 1978

A team from Hiroshima University surveyed sections of the Gorgan Plain in 1974 and 1976 resulting in the *Archaeological Map of the Gorgān Plain, Iran No. 1 and 2 (*Shiomi 1976; Shiomi 1978). The first stage of the Hiroshima University Scientific Expedition to Iran (HUSEI) was a survey undertaken in 1974 covered approximately 2000 km² in the western portion of the plain, mainly south of the Gorgan Wall. The second stage conducted in 1976 achieved the same amount of coverage, but this time to the east of the original survey in the foothills and plain immediately to the north of the Alborz Range.

In both surveys the dimensions of each site were recorded (length, width, height), and sketch maps were made, except in the case of sites in maps C5, D5 and E5 in which sites were sketched but only represented as a dot on the map. Photographs were also taken but these were not published along with the maps and gazetteer. The surveyors also collected artefacts from the surface of each site, excavated test pits Tappeh Anjirab, Golbaq Tappeh and Tappeh Hoseynabad and collected samples for scientific dating (Shiomi 1976 p.1; Shiomi 1978 p.1).

Over the course of the two seasons, 224 archaeological sites were surveyed and described in their gazetteer. This included 222 which were located on map sheets given letter and number designators (e.g. A3, B6) and described, plus two sites whose locations, sizes and morphology were described but were not located on the map. A further four sites were found on the maps that were drawn using the same symbology as the labelled sites, but had no accompanying label or description. Two of these are clearly Gorgan Wall forts.

Maps A3-A6, B3-B6, C5, D5 and E5 were remarkably accurate and georeferencing them was accomplished quite easily. The maps featured coordinates in both UTM and latitude/longitude in the margins, as well as site locations, shapes, geographical and topographical features (Figs. 1-8 – 1-18).

Maps C6, D6 and F4 (which included site E4) were not rendered in as great a detail as the other maps (Fig. 1-19). This has resulted in lower accuracy for both the geographical precision and boundary certainty of the sites. The maps feature a scale, but no coordinates (UTM or latitude/longitude) are present on the margins. Furthermore, no indication of site size is given in the maps, instead each site is located by a simple point. These maps were rectified to the best of my ability based on information on the locations of modern towns indicated on the maps. Therefore, a buffer of 1 km was placed around each site to represent the possible geographical location within an acceptable margin of error.

The assessments of boundary certainty and geographical precision for each category of site are listed in Table 3-13.

3.3.3.3 THE GURGAN WALL AND PARTHIAN SITES OF THE GURGAN PLAIN – M.Y. KIANI – LATE 1970S

Information collected by M.Y. Kiani (1982b) in the 1970s comes from three main sources within his publication. One, is the very detailed Gorgan Wall map that was clearly drawn from aerial photographs (Fig. 1-22 – Fig. 1-30). These maps roughly cover an area between 5-7 km both north and south and of the wall. Two is the 'Forts and Cities' map which is far less spatially accurate but gives rough locations for 31 sites, many of which are outside the area covered by the wall map (Fig. 1-21). Furthermore, this map is accompanied by scale drawings of 19 sites (16 of which are located on the map). The third source of information is the textual description of 26 sites that Kiani labels as either forts or cities with a likely Parthian component.

The Forts and Cites Map (Kiani 1982b Fig. 30-31) (Fig. 1-21), could not be georeferenced to a high enough standard to produce reliable locations for sites mentioned. When sites mentioned on the map could also be located on the CORONA imagery based on comparison to scale drawings and photographs the distance between the map location and the actual location was noted. Of ten sites located in this way the average distance between the locations was 3.7 km, even though the error ranged from 1.3 to 9.3 km. For the rest of the sites that only have location information from this above mentioned map, and could not be readily located on other imagery, a buffer of 4 km was placed around them to represent a likely area in which the site could be found. The Geographical Precision in this case is recorded as low (See Table 3-14).

In the case of four sites, the only indication of their location is a textual reference (i.e. 10 km east of Gurgan (Gonbad-e Kabus). A point was placed on the location indicated and a buffer of 10 km was applied, though even this may not be sufficient as often when the author refers to a site being east of a certain place, this could actually indicate any direction between northeast through to southeast.

3.3.3.4 SITE DISTRIBUTION MAPS PUBLISHED AS AN APPENDIX TO THE NARGES TAPPEH EXCAVATIONS - ICHHTO, GOLESTAN CULTURAL HERITAGE ORGANIZATION

Site visits conducted by Iranian archaeologists after 1998 were compiled and published as a series of maps (Abbasi 2011). Abbasi (2011 p.199) notes that the locations of all sites were recorded by using a GPS, however because of the different methods, and site naming processes used by each team, the task of accurately compiling the data was not without difficulties. Accompanying the maps was a site name list, but no further detail on size or condition was included.

For this study, UTM Coordinates (WGS 1984, Zone 40 N) indicated on the maps were used to georeference them in the GIS. The maps were presented by period, and sites were indicated on each map by a set of sequential numbers (Fig. 1-31 – 1-40). As such, the same site was listed on more than one map if it had multi-period occupation. After being translated by Farsi speaker Armineh Margussian, site names and locations were matched, resulting in one spatial location per site. The only exception were the 43 sites of the Parthian period map which do not have corresponding entries in the site list. These sites could only be assigned a site name if their location corresponded to a site indicated on the map of another period for which a corresponding site name was listed. This allowed for the identification of 35 Parthian sites, while the remaining eight do not have site names.

There was some difficulty in establishing the location of each dot on regional scale maps in areas of dense occupation due to the overlap of sites and labels. A buffer of 500 m was therefore applied to each dot to represent the likely location of each site within a margin of error. In many cases, the dots corresponded well to already known sites (from other surveys), or sites identified on the CORONA imagery. In other cases these dots did not clearly correlate to known sites from other surveys or sites visible on the CORONA imagery. This could be be for multiple reasons: they had not been previously recorded; are not visible on the imagery (including because of ground cover, e.g. forest); are beyond the area of the imagery or; the resolution of the map. The site certainty for these sites is detailed in Table 3-15.

3.3.4 MAPS AND SUPPLEMENTARY DATA SOURCES

Maps from other sources were also utilised and where possible incorporated into the GIS. Because of the early date of many of them, however, they could not be geo-rectified to a high enough standard so as to provide accurate spatial information useful to the database. Nonetheless, they can provide supplementary information on archaeological sites, pre-modern route systems, tribal boundaries etc. These include site location maps from early archaeological surveys, maps produced by early European travellers in the 18th and 19th centuries AD, and maps and itineraries from Medieval Persian and Arab geographers.

Data from several early archaeological surveys were not included in the database because the accompanying maps could not be geo-rectified to a sufficient standard to produce accurate site location data, they lacked dating information or they could not provide information that had not been gleaned from other surveys. The process of data entry into the database is extremely time-consuming, and therefore certain survey maps, namely those by de Morgan (1894) and Schmidt (1940) were not included in the database. However, they were consulted for information on specific sites when needed. Schmidt's (1940) aerial reconnaissance of the Gorgan Plain, in particular, has provided wonderful images of sites and features as they existed in the 1930s. The resultant map of their reconnaissance records approximately 200 tappehs or settlement ruins, though he notes that it was done rapidly and in an unsystematic manner (Schmidt 1940 Map 2, 57).

Also of use are the maps drawn up by early European travellers involved in the "Great Game" in the 18th and 19th centuries AD (e.g. Baker 1876; Marvin 1881; Muraviev 1871; Napier and Ahmad 1876) (Fig. 3-19 – Fig. 3-21). They recorded land forms, resources extraction areas, routes, tribal boundaries, and even archaeological sites. The majority of the maps can be roughly rectified based on the location of towns and villages still in existence today.

Lastly, maps and itineraries recorded by Medieval Persian and Arab geographers were utilised, especially to trace pre-modern route systems. This includes maps from what is known as the Islam Atlas, compiled by geographers such as al Idrisi, al Balkhi, al Istakhri, Ibn Hawqal, al Muqaddasi, Ahmad al Tusi, Ibn Said of Granada, Nasr al-din al Tusi between the 10th and the 13th centuries AD (Miller 1986a; Miller 1986b; Sarton 1927 p.461). In particular, al Muqaddasi provides detailed itineraries of travel routes in northeast Iran and through to western Central Asia (al Muqaddasi 2001 p.218–302). Le Strange (1905 p.364–432) also utilises the writings of many of the above named authors to reconstruct routes across the Gorgan region and into Central Asia. These maps cannot be rectified as they do not represent actual distances between locations, but instead give an impression of the distance and the main geographical features one might encounter on the journey. However, these maps and the accompanying textual descriptions allow for rough reconstructions of routes between known sites.

This chapter has provided an overview of the available data, its spatial quality and the methods that have been employed in order to compare survey data from different datasets. The following chapter will provide an overview of the ceramic chronology of the Gorgan Plain from the Iron Age through the Sasanian period, and assess the chronological resolution of the data discussed above.

4 CHRONOLOGY

This chapter will review the available ceramic evidence that has been used to construct the chronology of the Gorgan Plain from the Iron Age to the Sasanian period, drawing on comparative data from wider northern Iran and southwestern Turkmenistan where appropriate. I will then use this overview to assess the chronological data generated by individual surveys of the region, their comparability, and how this affects our overall interpretation of settlement and land use patterns on the plain.

Within the Gorgan Plain, no one site has produced a long-term sequence of occupation that has been absolutely dated and fully published. As a result, our understanding of the chronology of the region is incomplete and has been pieced together from materials from several excavations of sites in the Gorgan Plain. This includes Tureng Tappeh (Boucharlat and Lecomte 1987; Cleuziou 1985; Cleuziou 1986; Deshayes 1963; Deshayes 1967; Deshayes 1969; Deshayes 1973; Deshayes 1974; Deshayes 1975;) for which a sequence for the Bronze Age through Islamic periods is known (Fig. 4-1). These excavations have been published as preliminary reports, and one chronologically specific monograph, but there has not yet been an overall synthesis of the materials from the site. Furthermore, radiocarbon dates only exist for some of the Bronze Age horizons (see Erich 1992: Table 2). However, these excavations remain the best source of information for the long-term ceramic sequence of the plain.

The excavations at Shah Tappeh (Arne 1935; Arne 1945) have also provided considerable information on the Bronze Age sequence, though due to the early date of the excavations no radiocarbon dates exist. The re-assessment of the stratigraphy of the site (Orsaria 1995), and the comparison of the excavated contexts to similar assemblages at the site of Tappeh Hissar (for which radiocarbon dates are available) has allowed for relative dating of this assemblage (see Voigt and Dyson 1992: Table 2). At Yarim Tappeh (Crawford 1963; Stronach 1972) excavations also revealed a long-sequence of occupation from the Chalcolithic through to the Iron Age/Parthian period, though the ceramics from the excavations were never fully published. However, one of the early uses of radiocarbon dating in the region, comes from the earliest Iron Age layer at the site (Crawford 1963; Voigt and Dyson 1992). More recently, Iranian excavations at sites such as Pookerdervall (Zoshk and Zeighami 2013), which has provided information on the Neolithic through

Chalcolithic ceramic sequence, and Narges Tappeh (Abbasi 2011) which has provided information on the Late Neolithic/Early Chalcolithic through Islamic period. Radiocarbon dates are also available for part of the sequence at Narges Tappeh (Abbasi 2011: Fig. 11).

The excavations undertaken by the Gorgan Wall project (Sauer et al. 2013) have also resulted in further information on the ceramic chronology of the Iron Age III and the mid to late Sasanian period, along with a series of radiocarbon dates. Lastly, excavations in neighbouring regions (i.e. Tappeh Hissar (Dyson and Howard 1989), and Sang-I Chakhmaq (Roustaei et al. 2015; Roustaei et al. 2016; Thornton 2013a) have also provided invaluable comparative ceramic sequences for the Neolithic and Bronze Ages. An overview of the long-term ceramic chronology of the region is presented in Table 4.1.

In summary, and focusing the discussion on the periods that are within the temporal remit of this thesis, information regarding the chronology of the Late Iron Age through Islamic periods comes primarily from Tureng Tappeh. Further information on the Iron Age and early historic periods from Yarim Tappeh, Narges Tappeh, and of course the excavations undertaken by the *GWP* at Qelich Qoineq (Iron Age III). Lastly, because of the ongoing research by the *GWP* and *PNP*, the Sasanian period is now one of the better-known periods on the plain.

However, there are still significant gaps in our understanding. As with many studies of the region, this overview relies heavily on the data from excavations at Tureng Tappeh. With limited comparative material from sites in the region, it is difficult to pick out gaps in the settlement history of the wider region. Only with further excavations, with the possibility for absolute dates, can we begin to establish a reliable long-term sequence.

4.1 THE LONG-TERM CERAMIC CHRONOLOGY OF THE GORGAN PLAIN – THE IRON AGE THROUGH SASANIAN PERIODS

4.1.1 THE BRONZE AGE AND THE EARLY IRON AGE

The temporal remit of this study covers the Late Iron Age through Sasanian periods, but it is important to briefly provide an overview of developments in ceramic technologies of the region from the Bronze Age in order to provide context for a more detailed discussion of the Iron Age ceramics. The most recent comparative chronology for the prehistoric periods in north central and north east Iran and southern Turkmenistan can be found in Thornton (2013b p.189, Table 10.1) and should be referred to for a more in depth overview.

The most well-known Bronze Age ceramics of the Gorgan region are the Caspian burnished grey wares (BGW), which are fine, reduction fired, and smoothed, polished, or burnished to a high 'metallic' shine, though some red variants exist (Cleuziou 1991; Dyson 1991) (Fig. 4-2). These wares become dominant in the region by the mid to late 4th millennium (Boucharlat and Lecomte 1987 p.10; Deshayes 1967 p.131; Deshayes 1969 p.13; Dyson 1991; Thornton 2013b p.191–192) and BGW are found at many excavated sites such as Tureng Tappeh, Tappeh Hoseynabad, Yarim Tappeh and Shah Tappeh (Arne 1945; Crawford 1963; Cleuziou 1991; Deshayes 1969; Ohtsu et al. 2010). It has also been observed by Kohl (1984 p.114–115) that, while chronological refinement is needed, there appears to be a significant number of sites located in surveys of the Gorgan Plain that have characteristic Bronze Age BGW. He surmises that this may indicate an unprecedented increase in settlement on the plain concurrent with a similar peak in settlement in Southern Turkmenistan in the Early Bronze Age Namazga IV period. Indeed, there are a considerable number of sites in the Shiomi (1976, 1978) and Arne (1945) surveys that have polished or burnished grey wares on them, though it is difficult to be precise in the dating of these types without further refinement. However, Abbasi (2011: Map 7; Abstract 4) attributes a significant number of sites to the Early Bronze Age indicating that the pottery used to distinguish this phase finds comparisons in, for example, Shah Tappeh III, Tureng Tappeh III, Yarim Tappeh II, and Tappeh Hissar IIa.

The Late Bronze Age (LBA) or early 2nd millennium (equivalent to the Namazga VI period and which Thornton (2013b p.195) calls Late BMAC) appears to be a time of significant change in settlement on the Gorgan Plain. Many of the sites, thus far excavated, appear to be abandoned. The latest Bronze Age layers at Yarim Tappeh, dominated by pattern BGW contemporary to Hissar IIIB, have been suggested to end c. 1900 BC (Crawford 1963 p.271, 273). At Shah Tappeh, the final Bronze Age layers, with material comparable to Tappeh Hissar IIIC and Tureng Tappeh IIIC$_1$ can be placed similarly around the second half of the 3rd to the beginning of the 2nd millennium BC (Orsaria 1995 p.488). At Narges Tappeh, excavated more recently by an Iranian team, the last cultural layers of the Bronze Age on the site, also bear similarities to the Hissar IIIC and Namazga VI material (Abbasi 2011 Abstract 5 p. 5).

At Tureng Tappeh, occupation appears to continue later than at Hissar IIIC (whose terminal phase is placed at c. 1800) and the above mentioned sites (Cleuziou 1991; Thornton 2013b p.195). Tureng Tappeh $IIIC_2$ represents a phase of settlement on the site much reduced in size; however only a limited area has been excavated (Deshayes 1975 p.529–530).

Our understanding of the later Late Bronze Age phase and the subsequent transition into the early Iron Age on the Gorgan Plain, is at present, not very clear. While the start of this transition may be present, for example in Tureng Tappeh $IIIC_2$, there is still a significant gap in settlement at this site, and most other excavated sites on the plain until sometime in the first half of the 1st millennium BC. However, this 'gap' may be partly a consequence of a poor understanding of the ceramic chronology for this period, and/or an issue in recognising low intensity or low visibility occupation, an issue that will be discussed in more detail in subsequent chapters.

Excavations in wider northern Iran and southern Turkmenistan can perhaps provide more evidence for our understanding of the transition from the LBA to the Early Iron Age. The most cited example of possible late LBA to early Iron transitional ceramics are from the Sumbar Valley of southwest Turkmenistan. The grey wares of the LBA cemeteries in the Sumbar are clearly linked to the Bronze Age grey ware ceramic assemblages of the Gorgan Plain (Khlopina and Kohl 1981 p.55–56; Masson and Sarianidi 1972 p.156–157) (Fig. 4-3). However, direct parallels with sites like Tureng Tappeh and Shah Tappeh appear to be limited, and it has been suggested that the Sumbar ceramics represent a phase subsequent to the LBA settlement on these sites; however comparable material may be present at the site of Gohar Tappeh, west of the Gorgan Plain near the coast in Mazandaran (Mahfroozi and Piller 2009 p.195). The LBA burials from the site were characterised by ceramic types (carinated jars, incense burners, jugs with vertical handles, and bowls with open spouts) with some parallels to the LBA Gorgan Plain sites, but with greater affinities with the Sumbar assemblages mentioned above (e.g. the spouted vessels) (Fig. 4-4). This has led the excavators to surmise that most of the Gohar Tappeh LBA burials are from a date subsequent to the final occupation of sites like Tureng Tappeh. Furthermore, several ceramic forms of this period appear to have parallels (particularly carinated jars with cylindrical outcurved rim, jars with vertical handles) with forms found in LBA and early Iron Age sites of the Central Alborz suggesting links to the west as well. As such, the late LBA at Gohar Tappeh has been preliminarily dated to between the 17th and 13th centuries BC (Mahfroozi and Piller 2009 p.191–195).

4.1.2 THE EARLY IRON AGE

The Iron I and II periods in northern and western Iran have been dated to 1250 – 1050 BC and 1050 – 800 BC respectively based on excavations at Hasanlu (Danti and Cifarelli 2015 p.61), which lies over 800 km west of the Gorgan Plain. Although the scant evidence available for the Gorgan Plain for these periods makes it difficult to say whether these divisions are equally applicable to northeast Iran. In the Central Alborz region, Iron I/II ceramics come almost exclusively from burial contexts, and show a tendency toward regional diversity in forms, and appear to represent local evolution from the Late Bronze Age, though this is still a point of debate, and mechanisms involved in the spread of grey wares across the greater region in this period still need to be explained (Medvedskaya 1982; Mousavi 2008 p.114; Mousavi 2013). Early Iron Age pottery of the Central Alborz generally consists of fine, mostly grey wares, with a much smaller proportion of red or orange wares. They often have incised decoration and are burnished, but not pattern burnished as in the preceding Bronze Age. Characteristic forms include beak spouted vessels, open-spouted bowls, pedestalled plates and bowls, shirmaks (a type of decanter with tubular spout), and teapots (Mousavi 2005 p.67–78; Mousavi 2013 p.392–400; Sharifi and Motarjem 2014 Fig. 9, 10).

In the Gorgan Plain, there is a general lack of evidence for the Early Iron Age. This could be due to a shift in settlement and subsistence strategies, a lack of recognition of the material culture, and/or limited excavation. At Gohar Tappeh, there appears to be a gap in occupation after the Late Bronze/Early Iron layers discussed above, but by the 10th/11th century BC the site appears to be in use again as a burial ground. Most of the ceramics find parallels with forms from the Central Alborz, like shirmaks and pedestalled vessels (Mahfroozi and Piller 2009 p.195–197) (Fig. 4-4b). Iron Age assemblages from sites such as Yarim Tappeh, and the nearby cave site of Ke Aram might also provide evidence for re-occupation of the Gorgan Plain in the early Iron Age, but far too little of the material has been published to say anything meaningful. A radiocarbon date from Level 13 (one of the earliest Iron Age levels) at Yarim Tappeh led the excavators to suggest dating the start of the Iron Age layers c. 1100-1000 BC (Crawford 1963 p.270). However later recalculations, and further dates from Iron levels at Hotu Cave, have suggested that the earliest Iron Age dates from these sites are not earlier than 1200-1400 BC (Bovington et al. 1974 p.197)[10]. The early Iron Age ceramics from Yarim Tappeh were described as light grey, orange or brown and with resemblances to some of the material from Marlik (located in the Central Alborz) (Stronach 1972 p.23). Excavations at Ke Aram also reported Iron Age levels comparable to those of Yarim Tappeh; the assemblage included materials, such as the leg of a tripod bowl that D. Stronach indicated as similar to forms found in the early Iron Age layers of Yarim Tappeh (McBurney 1964 Appendix II). Based on the admittedly small sample of published examples, Cleuziou (1986 p.241) noted that the early Iron Age material from Yarim Tappeh may have affinities with the Sumbar material discussed above, but showed little similarity to the Iron Age material from Tureng Tappeh (see below), perhaps suggesting an earlier Iron Age date. However, the limited amount of data currently available limits any conclusions that can be drawn regarding the nature of occupation of the plain in the Early Iron Age.

4.1.3 IRON III

Occupation levels are again found at Tureng Tappeh in Period IV A, dating to the first half of the 1st millennium BC (equivalent to Iron III in the *GWS* chronology). These have been suggested to be equivalent to the late Iron II or early Iron III period in western Iran (again the applicability of these designations to northeast Iran can be debated), though establishing the chronology of these and subsequent layers (i.e. the Achaemenid period) proved difficult to the excavators (Boucharlat and Lecomte 1987 p.11). However, wares of this period find a significant number of direct ceramic parallels with the Archaic Dehistan complex of the Misrian Plain in Turkmenistan (Boucharlat and Lecomte 1987 p.11; Cleuziou 1985 p.177; Kohl et al. 1982 p.16; Lecomte 2005 Fig. 13) (see Figs. 4.6 - 4.9). Material of this phase, called Iron III in the *GWP* chronology, has also more recently been found at the site of Qelich Qoineq (see discussion below) excavated by the *Gorgan Wall Project* and recorded on a number of surveyed sites (Priestman 2013 p.511–520; Wilkinson et al. 2013 p.102–129) (see Figs. 4.5 – 4.9). While ceramics from Qelich Qoineq were studied in detail, no thorough comparative study had been undertaken until now and the significance of this site within the regional sequence is just beginning to emerge.

[10] Cleuziou (1986 p.241) suggested that the date of 1086 +/- 61 B.C. from Bovington et al. 1974 at a higher confidence level could range anyway between 1400 and 800 BC.

In the Tureng Tappeh IV A assemblage Cleuziou (1985 p.176) indicates the predominance of a red, orange or brown ceramic with a grey core, the surface often scraped, smoothed or burnished. A smaller percentage of the same ceramic, but in a grey colour, and a "*céramique á pâte rose et engobe blanchâtre*" were also found. The characteristic forms of the red ceramics include tripod bowls, hemispherical bowls, large pitchers with flared necks and rounded or tapered rims, and spouted vessels characterised as teapots (Cleuziou 1985 Fig. 6, Fig. 7 no. 1 and 2, Fig. 8, no. 1, 2, 5 – 9). A few tripod bowls, tankards, globular vessels with open and bridged spouts, and teapots are also found in the grey ceramic (Cleuziou 1985 Fig. 8 no. 11, Fig. 9 no. 1). In the "*céramique á pâte rose et engobe blanchâtre*" forms include pitchers, with flared necks and rounded rims, ovoid bottle/flasks with flared necks and tapered rim, concave lids with knobs, and lids with hooks and perforation (Cleuziou 1985 Fig. 7 no. 2, 7 and 8, Fig. 11 no. 1-3). Coarse wares teapots and cooking pots were also found, as was a very small sample of an incised fine black pottery, with white paste infilling the incisions (Cleuziou 1985 p.176) (See Figs. 4-6 – 4-8).

Excavations, and extensive survey by the Gorgan Wall Project at the site of Qelich Qoineq located north of the Gorgan River in the western steppe region of the plain, have resulted in a well-studied and dated ceramic assemblage with elements clearly comparable to the IVA levels at Tureng Tappeh (Fig. 4-5 – 4-9). There are both fine and coarse wares represented. The fine wares are hard and well-fired, and often burnished and come in a red, grey or cream colour (HARC.R, HARC.G, HARC.C respectively), with red being the most common. Many of the forms were found in all three colour varieties. The common forms included jars with everted rims (J5) (Fig. 4-3), and hemispherical bowls with a simple rounded lip (B3). The most distinguishing forms of the period are tripod legged bowls (B4) and the vessels with spouts (open at the end) (SP1, SP2) (Priestman 2013 p.465–502 for the type catalogue) (Fig. 4-7 - 4-8). The coarse ware cooking pots of the period are not particularly distinctive but are represented by two classes (CORTEM and HARTEM) (Priestman 2013 p.515–520).

The assemblages of Tureng Tappeh IVA and Qelich Qoineq are clearly related. The distinctive tripod bowls are found at both sites, though they are almost exclusively red at Tureng Tappeh, while at Qelich Qoineq they are predominantly found in the grey ceramic (Cleuziou 1985 Fig. 6 no. 1,2,4; Priestman 2013 p.521, Fig. 18.22) (Fig. 4-8). Hemispherical bowls, jars with everted rims and spouted vessels are also common to both assemblages (Cleuziou 1985 Fig. 6 no. 8 and 9, Fig. 7 no. 1, 3, 4 and 5, Fig. 8 no. 1,2, 5 – 7, 9-11;

Priestman 2013 Fig. 18.21-18.27). Interestingly, the concave lids with knobs in the "*céramique á pâte rose et engobe blanchâtre*" found at Tureng Tappeh (Cleuziou 1985 Fig. 11 no. 1-3) are very similar to the lids in HARC.C at Qelich Qoineq (Priestman 2013 Fig. 18.26 a-c) (Fig. 4-9). HARC.C is a cream coloured ware that can display streaky pink effect caused by firing (Priestman 2013 p.463).

Many of these wares are comparable to parts of the Iron Age material of the Archaic Dehistan complex that was identified initially in Soviet, and later in French excavations of settlements in the Misrian Plain of southwest Turkmenistan (immediately north of the Gorgan Plain) on sites such as Madau Depe, Izat Kuli, Benguvan, and Geoktchik Depe, as well as at Parkhai in the Sumbar Valley and several small sites on the western side of the Kopet Dagh near modern Serdar (formerly Kyzyl Arvat) (Chlopin 1973 Fig. 6; Kohl 1984 p.200–208; Lecomte 2005 Fig. 13; Muradova 1991 Figs. 28-32). In the Sumbar, there appears to be a link between the later LBA cemeteries mentioned above, and the early Iron Age (Archaic Dehistan) material from the site of Parkhai-Depe and related cemeteries, though more research is needed to understand the timing of these changes (Cleuziou 1986 p.242–243); (Kohl 1984 p.135–139, 206) (see Fig. 4-3).

The pottery is mostly fine grey ware, often burnished (with lesser amounts of red and light green wares), though there is also a coarse ware. The most characteristic forms are tripod bowls, spouted or beaked vessels, vessels with handles (sometimes ornamented) and pedestal bowls, the latter of which are suggested to relate to the previous grey ware tradition of the Gorgan Plain (Askarov et al. 1992 p.454; Kohl 1984 p.203–207; Masson and Sarianidi 1972 p.156–157, Fig. 44; Muradova 1991 Figs. 28-31). Similarities between the assemblages of Tureng Tappeh and the sites of Isat Kuli and Madau Tappeh in the Misrian plain were noted by Cleuziou; he drew particular attention to identical spouted vessels, tripod bowls, pitchers, tankards, teapots as well as the "*céramique á pâte rose et engobe blanchâtre*" lids (Cleuziou 1985 p.177; Cleuziou 1986 Fig. 5; Muradova 1991 Figs. 23, 24, 26, 29). Similar types are also found in the pottery from Benguvan, also in Misrian (Muradova 1991 Fig. 4 no. 4, 5 and 6, Fig. 5 no. 6-9, Fig. 8 no. 1-5, 18, 21), as well as similarities in the cooking pot shapes from Benguvan with the type CP5 LAGTEM vessels from Qelich Qoineq (Muradova 1991 Fig. 6 no. 1-7; Priestman 2013 Fig. 18.32). Excavations at Geoktchik Depe, in Misrian, for which the ceramics have yet to be fully published also provide us with a parallel in the ubiquitous tripod bowl (Lecomte 2005 Fig. 13) (See Fig. 4-8)

The Archaic Dehistan complex has been dated to between c. 1500/1100 – 800/500 BC. While the Archaic Dehistan period is traditionally thought to have ended around 800 B.C, based on excavations at Geoktchik Depe in the Misrian Plain, Lecomte (2005 p.465; 2007) has argued that the sequence extends down to c. 500 BC. The absolute dating of one of the outer mounds at Qelich Qoineq (to between the 8th and 5th centuries BC), may support this suggestion. Three radiocarbon dates extending from some of the latest to some of the earliest occupied layers at Trench P have produced calibrated dates at 95.4% confidence of 761-416 BC (2469 ± 26 BP), 756-415 BC (2463 ± 26 BP), and 791- 543 (2521 ± 26 BP) respectively (Sauer et al. 2013 Table 14.1, Fig. 14.10) (See Table 6-16 and Fig. 6-36). The rather tight range of dates suggests that the site was occupied for a relatively short period of time between the 8th and 5th centuries BC. Unfortunately, for the 8th through 6th centuries BC, the radiocarbon calibration curve is flat rendering more precise dating within this range difficult (see Sauer et al. 2013 p.418–419 for further discussion). However, even if the maximum range of dates is used, the occupation of this particular part of the site could not have spanned more than 376 years. Even taking into consideration that only a very limited area of the site was excavated, the uniformity of the ceramic assemblage collected intensively from across the site shows very little change (Priestman 2013 p.519). However, due to a lack of radiocarbon dates for other sites of this period (i.e. Tureng Tappeh) and the uniformity of the Archaic Dehistan material observed throughout excavated assemblages (Cleuziou 1986 p.240; Kohl 1984 p.201 citing Lisitsina 1978), it is difficult to establish the exact chronological relationship between these sites, or be entirely sure for how long Qelich Qoineq was occupied. Masson, the original excavator of many of the Dehistan sites, suggested a decrease in burnished grey or black wares as the through time. This corresponded to an increase in red burnished wares; as such, this led to tentative suggestion that the higher ration of red ware to grey ware in period IV A at Tureng Tappeh might indicate that it comes later in the Archaic Dehistan sequence (Cleuziou 1986 p.240 citing Masson). At Qelich Qoineq HARC.R (the red variation of the fine ware) also dominated the assemblage (Priestman 2013 p.515). The prevalence of red ware could therefore be a chronological indicator, placing Tureng Tappeh, along with Qelich Qoineq toward the end of the Archaic Dehistan sequence, but equally it could also represent a geographical variation. Small quantities of a fine black incised pottery were found at Tureng Tappeh (Cleuziou 1985 p.176), but not a Qelich Qoineq. Conversely, there is no mention of a reddish purple slipped ware (REDSLIP) or a red burnished black painted ware (BLALIN), both found in small quantities at Qelich Qoineq (Priestman 2013 p.517) but not in the Tureng Tappeh assemblage. These facts may support the idea of some degree of chronological variation between the occupations of these sites (or an issue of a small sample).

The relationship between the Iron III assemblage, as represented by Tureng Tappeh IV A (and Qelich Qoineq), and that of subsequent phases on the Gorgan Plain is also not clearly defined. Being a single period site, Qelich Qoineq does not hold the answers. Once again Tureng Tappeh appears to be the best candidate for understanding this transition. Period IV B at Tureng Tappeh, which appears to immediately follow IV A, has been interpreted as representing a different ceramic tradition (Lecomte and Boucharlat 1987 p.11) correlated by the excavators with the Iron III period of Western Iran (traditionally placed between the late 8th to early 5th century BC) (no radiocarbon dates are available for the Iron Age at Tureng Tappeh). With absolute dating of the assemblage from Qelich Qoineq between the 8th and 5th centuries BC, and its notable similarity to that of IV A at Tureng Tappeh, questions arise as to the suggested dating of period IV B which may only be answered with future excavations or the full publication of the ceramic material from Tureng Tappeh.

The majority of ceramics of Tureng Tappeh IV B are characterised by a buff fabric, often smoothed or burnished (Fig. 4-10). Characteristic forms include bowls with 'bayonet edges', or carinated plates and bowls with flared rims. Red ceramics still persist but represent a much reduced percentage of the assemblage as compared to the preceding period (Cleuziou 1985 p.180–181; Deshayes 1974 p.491). In general, there are very few parallels for these wares in the Archaic Dehistan assemblage of the Misrian Plain (Cleuziou 1985 p.181), and furthermore the buff/light brown fabrics and carinated forms characteristic of Tureng Tappeh IV B appear to be absent from the Qelich Qoineq assemblage (compare the material in Fig. 4-5 - 4-9 from Qelich Qoineq with the material in Fig. 4-10 from Tureng Tappeh). Possible parallels for these ceramics from the Gorgan Plain come from graves at Aq Tappeh; this includes grey wares with possible similarities to Tureng Tappeh IV A, and buff or apricot wares with carinated or out-turned rims bearing resemblances to Tureng Tappeh IV B (Azarnoush and Helwing 2005 p.199; Mahfroozi and Piller 2009 p.197; Shahmirzadi and Nokandeh 2001 Plate 20-22). Because of the limited number of excavations covering this period, comparative material is generally absent. Equally, little recognition of these Tureng Tappeh IV B ceramics are apparent in published surveys of the region. However, in the assemblages collected during the surveys of the *GWP*, ceramics clearly relating to, but also post-dating the Qelich Qoineq (Iron III) assemblage were located on several sites. These ceramics, broadly termed Iron IV, while requiring further chronological refinement suggest a continuity in at least some elements of the ceramic tradition from the Iron III period onwards perhaps suggesting a less abrupt shift (Wilkinson et al. 2013 p.113, 116, 119). Indeed, while Cleuziou (1985 p.180–182) noted parallels in the Tureng Tappeh IV B assemblage with western Iran, especially of the northern variant of what Young (1965 p.72–74, Figs. 1-4) defined as the Late Buff Ware Horizon, he cautioned that it was hasty to assume this meant the ceramics were intrusive and represented the movement of people from the western regions. This is in contrast to the interpretation of Deshayes (1969 p.31; 1979) who explained similarities between the ceramics of Tureng Tappeh IV B (and interestingly of the preceding IV A period) and western regions as evidence for the origins of the Iron Age inhabitants of the Gorgan Plain lying in Western Iran and more specifically with the Medes. Similar theories had been postulated about the appearance of buff ware ceramics of later Iron Age date in western Iran (Young 1967 p.3). Up until the 1970s, such arguments about mass migrations dominated discussions of the Iranian Iron Age, and the transition between the late Bronze Age and the early Iron Age in greater northern Iran. While the enthusiasm for migrationist explanations has abated in recent years, these ideas have remained largely unchallenged due to the limited publication of the primary data (Danti and Cifarelli 2015 p.64). Further excavations and reassessments of earlier excavated collections are sorely needed to better understand the long-term development of ceramics in the region, along with the complex local and regional networks that connected the Gorgan Plain to both western Iran and Turkmenistan in the early Iron Age.

4.1.4 THE ACHAEMENID THROUGH PARTHIAN PERIODS

A change in architectural elements such as brick size and shape (from rectangular to square) indicate the beginnings of what the excavators of Tureng Tappeh designated period V (Cleuziou 1985 p.182). V A has been ascribed to the Achaemenid period, V B to a Post-Achaemenid phase (possibly extending to the early Parthian period and encompassing what Deshayes (1973) called 'Hellenistic'), and V C to the Parthian period. A further phase final V C – V D was later added representing a phase of occupation between the 1st and 2nd centuries AD (Boucharlat and Lecomte 1987 p.11, 101). While designators such as Achaemenid, Hellenistic and Parthian are useful to indicate broad time-periods, they come with attached implications about changes in the ceramics sequence being brought about by the influence of external empires. Because of the long tradition of discussing the periodisation of this, and other regions, in this way, using these terms is difficult to avoid. Indeed, in our own project's work, we refer to Sasanian ceramics. These perhaps, could be better described as ceramics of the Sasanian period, but that would be a more cumbersome designator. What will become clear in the following discussion, is that there is a clear evolution of certain ceramic forms and fabrics from the Iron Age (and arguably from the Bronze Age). However, interactions at the regional and interregional levels, have in some cases, resulted in the appearance of new forms that are, because they are distinct, particularly useful for interpreting survey data.

At Tureng Tappeh, period V A, along with architectural changes, is said to be marked by the disappearance of the buff ware of the previous phase and the appearance (or re-appearance) of red-wares as the dominant ceramic type, often smoothed or burnished (Cleuziou 1985 p.182, Figs. 4 - 8). Hard burnished red wares were also common in the earlier Qelich Qoineq Iron III, and Tureng Tappeh IV A, suggesting continuity; Haerinck (1983 p.196) also observed that this ceramic type dates at least back to the Iron Age. There is also continuity from period IV B in some forms such as carinated bowls and plates (Fig. 4-11), while a variety of vessels with tubular spouts suggests relationships with forms extending back to the early Iron Age if not the Bronze Age. Zoomorphic handles are also very characteristic and closed forms are rare (Cleuziou 1985 p.182). These burnished red ceramics make up the majority class found throughout Tureng Tappeh V (Haerinck 1983 p.191). Similar forms are said to exist in the Iron Age levels eight/nine to six at Yarim Tappeh (equated to the Achaemenid period), but since the material has not been published in detail it is difficult to comment further (Haerinck 1983 p.180, 197, Fig. 33 no. 1).

As Cleuziou (1985 p.184) notes, the minimal sample from Tureng Tappeh attributed to period VA makes it difficult to draw too many comparisons between the ceramics of this phase and other sites. However, variations of the carinated bowls with tall flared rims found in Tureng Tappeh VB (e.g. Cleuziou 1985, Fig. 24) find form parallels in geographically wide ranging Achaemenid assemblages from places such as the Persepolis Plain and Sardis (Cattenat and Gardin 1977, Fig. 5; Dusinberre 1999, Fig. 4, 9, 11; Sumner 1986a, Fig. 1, 2). Furthermore, others have drawn comparisons between the carinated bowls and plates from both period IV B and V A and ceramics from Pasargadae (Genito 2013: 624).

Burnished red wares also form one of the four categories of Parthian pottery identified for northeast Iran in Haerinck's (1983) study, indicating that this ware type, or a variation of it, continued in use into the following period. At the site of Shahr-i Qumis (on the southern side of the Alborz, west of Damghan) likely occupied between the 3rd and 1st centuries BC, burnished red ware is found in significant quantities (about a third of the assemblage) and forms include carinated bowls and cups, vessels with tubular spouts, zoomorphic handles or handles with pastilles for decoration, tripods, jars and pitchers (Haerinck 1983 p.191–192; Hansman and Stronach 1970). In the recent Iranian excavations at Narges Tappeh, parallels can also be found in reddish brown ware forms attributed to Iron IV (probably dating to the 1st or 2nd centuries BC, but possibly as early as the mid-4th century BC)[11] (Abbasi 2011 p.142, Fig. 289; Haerinck 1983 Figs. 10, 13, 33).

The other categories of ceramics that Haerinck described as characterising the 3rd to 1st centuries BC are what he calls a common ceramic, a grey and grey/black ceramic, and a group called *céramique sonore* (Haerinck 1983). The designation "*sonore*" stems from the metallic sound that the pottery makes when struck against a surface. His *céramique sonore* group included wares variably called *céramique sonore*, *céramique à bord contraste*, and *céramique flammée* in excavations at Tureng Tappeh (see Fig. 4-12 and 4-13). Subsequent to Haerinck's classification, Besenval (1987) undertook a technical study of *céramique sonore*, *céramique à bord contraste*, *céramique flammée* and a type that Deshayes (1973; 1974) called *céramique noire* (which correspond to a part of Haerinck's grey/black ceramics) and determined they were all variations of the same type. These wares are characterised by thin, hard, well-fired ceramics, in both red and black. While Haerinck (1983) discussed the *céramique sonore* as a type of Parthian ceramic, its variations, appear to be present from period VB (and possibly period VA – Achaemenid?) at Tureng Tappeh and continue through the Parthian period.

Céramique à bord contraste and *céramique flammée* are distinguished by a bichrome appearance (red to grey) (Fig. 4-12). Examples have a flamed appearance, a contrasting

[11] At Narges Tappeh, period II is said to date from the Iron Age III/IV period. Radiocarbon dates from Stratum 2 of Trench J23 in their excavations (which they associate to the Iron III/IV period) give a set of radiocarbon dates indicating occupation in the 1st and 2nd centuries BC, with one outlying date in the middle of the sequence dating between 359 and 277 BC (see Abbasi 2011 Table 4). Based on the radiocarbon dates, the ceramic assemblage, and the lack of obvious parallels with either Qelich Qoineq or Tureng Tappeh IV B, it is likely that the Narges Tappeh II assemblage falls mainly into the Iron IV period (if defined as encompassing the Achaemenid through early Parthian periods).

edge, or floral patterns (obtained with the use of plant material) generated by the firing process. Because stacking the vessels in the kiln (so that parts of the surface oxidise and others do not) is essential to achieve these patterns, the vessels are limited to open forms (Besenval 1987 p.404–407, Figs. 105-112). The origins of the technique may be found in earlier periods (Iron Age, or Tureng Tappeh V A?) but find their highest concentration in period V B (Cleuziou 1985 p.182; Deshayes 1973; Haerinck 1983 p.198). Pottery of the *céramique sonore* tradition is also found at Yarim Tappeh, Narges Tappeh and Shahr-i Qumis (Abbasi 2011 p.147–148, Figs. 309, 310, 313, 314; Crawford 1963 p.270, 273, Fig. 9; Hansman and Stronach 1970 p.56, Fig. 14.6). At Yarim Tappeh, fine red wares including *céramique flammée* are said to be found in levels seven through three of the Iron Age sequence (Crawford 1963 p.273) though Haerinck (1983 p.180, 197–198) suggests they are present from layer five, with the highest density of *céramique flammée* in levels three and four. At Narges Tappeh, flamed wares are recognised as being present throughout their Iron III/IV sequence (Abbasi 2011 Abstract p. 5).

The *céramique noire* appear in phase V B at Tureng Tappeh (Besenval 1987 Fig. 106 a, b; Deshayes 1973 p.149, Pl. IIIc) (Fig. 4-13). Vessels are grey black or black, and are often burnished or partially burnished (but can also be left untreated), and can have a shiny (or partially shiny) appearance (Besenval 1987 p.406–407). Forms are limited and include small bowls and goblets with thin walls (giving some the name "eggshell ware") and pedestaled cups and bowls (Haerinck 1983 p.190). Examples are found at Narges Tappeh II (associated with their Iron IV period) (Abbasi 2011 p.140–141, Figs. 277-288), at Yarim Tappeh in level 5 of the Iron Age sequence (Haerinck 1980 Fig. 3.9) and at Shahr-i Qumis (Deshayes 1973 p.149; Hansman and Stronach 1970 Fig. 15 no. 1-4).

Deshayes (1973 p.149) saw this ware as an imitation of Greek ceramics and hence suggested that early Tureng Tappeh V B was representative of the Hellenistic period. Indeed, several sherds of Attic black-glaze ware, and *céramique noire* ware were found at Shahr-i Qumis (Haerinck 1983 p.190; Hansman and Stronach 1970 p.34). However, what this implies about the socio-political situation in the region is more difficult to understand; it has been suggested that direct Hellenistic influence on material culture in the greater region should not be overstated apart from at sites such as Nisa and Susa (Hauser 2013 p.742–743). However, local production of Hellenistic inspired pottery has been noted for a wide geographical area, from Uruk in Mesopotamia to Ai Khanoum in Afghanistan (Hannestad 1983a, 1983b; Petrie 2002). The *céramique noire* of northeast Iran has clearly developed from a local ceramic tradition (i.e. *céramique sonore)*, but appears to reflect some connections and influences of the wider Hellenistic world. Interestingly, while new vessel forms (e.g. bowls with incurved rims, fish plates etc.) associated with the Hellenistic period appear in geographically wide-ranging assemblages, this does not appear to be the case for the Tureng Tappeh *céramique noire* assemblage (Hannestad 1983a p. 112).

Ceramics of the general *céramique sonore* category continue in use into early Period V C at Tureng Tappeh, though it appears in slightly lesser quantities (Haerinck 1983 p.198). The beginning of V C has been dated to the 1st century BC on the basis of ceramic parallels at Shahr-i Qumis, an ostracon and an inscribed vase with parallels to Nisa, and a Parthian coin of the 1st century BC that was found out of context in later layers (Lecomte and Boucharlat 1987 p.100–101).

Lecomte (Boucharlat and Lecomte 1987 p.101) has suggested a hiatus between V C and the phase he calls final V C-V D, for which they suggest a date between the 1st and 2nd centuries AD. An ashy layer separates this phase from V C and the *céramique sonore* discussed above disappears. In northeast Iran in general, *céramique sonore* appears to drop out of use during the 1st century AD (Haerinck 1983 p.198). In Tureng Tappeh final V C – V D, the excavators identified only two types of ceramics; a coarseware, and a mostly red (though sometimes brown, grey or beige ware). The coarse wares are mostly cooking pots, while both open and closed forms are found in the red wares. The open forms include bowls, with distinctive slightly thickened and out-turned rims (Boucharlat and Lecomte 1987, Plate 41-42) (Fig. 4-14). The most common closed forms are pitchers or jugs with concave necks, thickened rims and vertical handles (Boucharlat and Lecomte 1987 p.98–99). While the "*céramique sonore*" and its derivatives from Tureng Tappeh have received considerable attention in the available studies, very little of the majority red burnished wares from V A – V C have been published making it difficult to trace the evolution of any forms from the early part of period V to those of V C - V D. Overall, full publication of the Iron Age through Parthian materials from Tureng Tappeh would be an immensely useful addition to the ceramic sequence of the region.

4.1.5 THE SASANIAN AND ISLAMIC PERIODS

At Tureng Tappeh, there appears to be a gradual transition between the ceramics of period V C final – V D and the layers associated with the Sasanian Fort of levels VI A/B (Boucharlat and Lecomte 1987 Plate 46-47). In this period the excavators still only define two main wares; a common ware, and a coarse ware. Period VI is divided into two phases based on the stratigraphy, but no difference is apparent in the ceramics from the available evidence (Boucharlat and Lecomte 1987 p.103–104). Distinctive in this phase is the introduction of incised decoration on the shoulders or neck or pitchers/jugs (including undulating sets of lines), lines of vertical burnishing (sometimes in combination with incised decoration), and pastilles applied to handles. New forms in this period include pitchers with pinched spouts and jars with rims thickened on the exterior, with a sort of 'guttering' (Boucharlat and Lecomte 1987 Plate 60-61) (Fig. 4-15). This is the same rim type designated as J9 in the Gorgan Wall assemblage (Priestman 2013 Fig. 18.5).

Comparisons of the ceramics of the Tureng Tappeh VI with those from Shahr-i Qumis and the Sasanian building at Tappeh Hissar suggested to the excavators that all of these assemblages should be dated to before the 6th century AD. Furthermore, comparisons to sites in Central Asia have led to the dating of Tureng Tappeh VI to between the 3rd and 5th centuries AD (Boucharlat and Lecomte 1987 p.113). The dating of period VI at Tureng Tappeh to an earlier part of the Sasanian period is also supported by Priestman's (2013) analysis of the ceramics from excavations at Qal'eh Kharabeh (GWS_1) and Fort 4 (FORT_8) by the *GWP.* The assemblages from the *GWP sites* have been dated to the (early) 5th – (mid) 6th centuries AD (Qal'eh Kharabeh) and the mid-5th to early 7th C. AD (Fort 4); they share commonalities with certain types at Tureng Tappeh (such as the apparently long-lived J9 rim type), but represent a later horizon (Priestman 2013 p.527–528).

In the mid to late Sasanian ceramic assemblage from the *GWP* sites, summarised below from Priestman's (2013 p.452–485) detailed study, red burnished ware (REDBUR), so called because of the burnished lines characterising its exterior surface, is by far the most common class. Jars are the most frequent form (Fig. 4-16). Both a fine pink/cream burnished ware (PINBUR) and a mottled brown/purple burnished ware (MOTBUR) appear to be closely related to REDBUR, and are also dominated by closed forms (J1 and J3 rims). Another of the most distinctive types associated with Sasanian assemblages is a red plain or incised ware (REDPLI), clearly related to REDBUR, but not usually burnished and instead having incised decoration (combed bands straight or wavy). Again the most common forms are jars (J1 and J2 rim types, the latter which is specific to this class). Grey wares (SMOG) and cream wares (SELSCEP and CREWE) are also found in lesser quantities. Grey wares are mostly in simple forms, while in cream wares, both, bowls and jars are common and mostly undecorated; In CREWE, however, lamps have been found, as well as some possible examples of glazed decoration.

Two classes of cooking pots are also significant (Fig. 4-17) due to their frequent occurrence in mid to late Sasanian contexts. Mixed grit tempered ware (MIGTEM) is black, dark brown or orange in colour, and distinguished by series of horizontal and vertical overlapping incised lines all over the surface. White grit tempered ware (WIGTEM), ranging in colour from buff to black has only one form; "a flat bottomed cooking-pot with low rounded sides, an upward flaring rim, simple rounded lip and rounded strap handles on each side attached at the shoulder. The handles have fattened terminals and a vertically projecting, solid flat-topped thumb-stop" (Priestman 2013 p.458).

A later phase of Sasanian activity on the plain may be respresented by period VII A/B at Tureng Tappeh, which consists of pits dug into the early levels of the Sasanian Fort (VI), a house, and the foundation level of a fire temple. Red and red brown pottery are found in equal quantities, and closed forms are the most common, some with incised (combed) decoration (Fig. 4-18). The rim type J9 (as defined in the Gorgan Wall excavations) is still apparent, but a new variation with a straightened extremity exists, as well as a wider variation in types of jugs with pinched spouts (Boucharlat and Lecomte 1987 p.116–117). The excavators, based on comparisons to Sasanian sites in the Misrian Plain (dated between the 6th and 8th century BC) and the stratigraphy, suggest that period VII A/B likely dates to the 7th - 8th centuries AD (Boucharlat and Lecomte 1987 p.118), and as such could represent both the Late Sasanian and Early Islamic period. Indeed, Period VII A/B at Tureng Tappeh, is quite different from the Fort 4 (FORT_8) assemblage, and appears to significantly postdate it, possibly representing a transition to the Early Islamic period (Priestman 2013 p.528). Following this, the excavators suggest that after a short time large pits were dug into the earlier occupation layers on top of the mound from which pottery and glass objects were recovered; this period was defined as VII C (Fig. 4-19). No contemporary settlement was found, and evidence for activity at the site did not resume until the 12th/13th century AD (Boucharlet & Lecomte 1987: 77). All in all, there is still considerable work to be done in making more specific chronological connections between the assemblages from Tureng Tappeh and the sites excavated by the *GWP* that will hopefully come with reassessments of old collections and future fieldwork.

The ceramics of the Islamic period on the Gorgan Plain were further defined through the excavations of Jurjan/Gorgan near modern Gonbad-e Kabus undertaken by M.Y. Kiani (1984). In his study, Kiani (1984 p. 39-40) differentiated six ceramic periods: Sasano-Arab, Early Islamic (8^{th} – 10^{th} centuries AD), Seljuk (11^{th}-12^{th} centuries AD), Khwarazmshahid (12^{th} century – 1220 AD), Ilkhanid (13^{th}-14^{th} century), and Timurid and Safavid (14^{th}-18^{th} centuries). The Sasano-Arab wares are noted as very similar to those of the preceding Late Sasanian period, and include monochrome and unglazed types (Kiani 1984 p. 40), though none are illustrated. These could bear similarities to the VII A/B and C wares at Tureng Tappeh, but this is unclear. The unglazed ceramics of the Early Islamic period can be incised (a series of wavy lines appears common) or include moulded and painted decoration. Glazed wares are of course the most common and varied, and include black on white ware, polychrome ware, splashed ware, sgraffiato ware, monochrome ware, lustre painted ware, underglaze painted ware, and overglaze painted ware and find parallels within Iran and the wider Islamic world (Kiani 1984 p. 39-69). Even without a detailed understanding of the forms or specific decoration type, glazed wares are clearly datable to a broad Islamic horizon and as such, Islamic period sites are the most consistently and confidently identified in many survey gazetteers (for example see Arne 1945; Shiomi 1976, 1978).

4.2 CONNECTIONS AND CULTURAL FRONTIERS

The above summary provides a general overview of the chronology of the Gorgan Plain between the Iron Age and the Islamic period based on the existing ceramic evidence. It is, however, not exhaustive, and is based mainly on the excavated material published in English and French; summaries of recent excavations being undertaken by teams of Iranian archaeologists and published in Farsi have been selectively used where the materials, and translation has been available. However, there is a wealth of information that was unfortunately not accessible to me for this study. It is hoped that in future more of this material can be brought into the discussion.

The transition between the Late Bronze Age and the Early Iron Age on the Gorgan Plain, while still poorly understood, reflects both local developments, and regional connections. Ceramic affinities between the Bronze Age grey wares of Gorgan, the LBA and early Iron Age material of the Sumbar valley and the Early Iron Age material culture of both Dehistan and the Iranian Plateau need to be more completely explored (Kohl et al. 1982 p.19). The unearthing of later LBA graves at Gohar Tappeh seems to confirm a link with the material culture of the Late Bronze Age Sumbar Valley. However, by roughly the Iron II period, Gohar Tappeh has reoriented itself with much stronger links to other sites of the Central Alborz and according to the excavators there appears to be little similarity to the ceramics from the Archaic Dehistan complex (Mahfroozi and Piller 2009 p.204). By contrast, sites on the Gorgan Plain (i.e. Tureng Tappeh and Qelich Qoineq) are clearly linked by the material culture to Dehistan in ways which require further investigation and explanation (See chapter 6).

The following period IV B, defined at Tureng Tappeh presents a bit of an anomaly. There seems to be little published comparative material from elsewhere on the plain (with the exception perhaps of Aq Tappeh), and more evidence is needed to speculate on connections with western Iran. In the Misrian plain, it has been suggested that the Archaic Dehistan forms continue in use through to the Achaemenid period (Lecomte 2007 p.301), perhaps suggesting a different trajectory of development from the Gorgan Plain, but this of course can only be confirmed with further excavations.

Historically, by the reign of Darius I (522-486 BC), the Gorgan region is part of the province known as Parthia in various Achaemenid provincial lists, while the Behistun inscription indicates that Darius dealt with revolts in *Parthava* and *Varkana*; the latter place name giving us the classical name of the region Hyrcania, and the modern name Gorgan (Genito 2013 p.624; Vogelsang 1992 p.20, 94-122). The association of level V A at Tureng Tappeh with the Achaemenid period is basely largely on a change in architecture and brick forms at the site. Continuity in pottery from previous periods, along with clear evolution into the following periods make it difficult to talk about an 'Achaemenid' or subsequently a 'Hellenistic' pottery assemblage. Genito (2013 p.324) suggests that red wares found at Tureng Tappeh can be likened to those found at Pasargadae, and certain ceramic forms are suggestive of geographically wide-ranging Achaemenid ceramic types (e.g. types of carinated bowls). Similarly, the *céramique noire* may represent the local production of Hellenistic wares, but not necessarily forms (1983a). However, considering the regionality of ceramic assemblages in succeeding periods (Haerinck 1983 p.255), it would be surprising to see similarities in all aspects of the assemblage.

Haerinck's (1983) influential study of Parthian ceramics in Iran suggests that in this period there are significant regional differences, perhaps stemming from regional political autonomy, or previous local ceramic traditions. However, they equally reflect geographical regions and might more crucially be reflective of local and regional networks and cultural connections (Hauser 2013 p.737). For the Parthian material at Tureng Tappeh, Boucharlat and Lecomte (1987 p.101–102) find very little comparable material in Mesopotamia or on the plateau, but stronger ties with Central Asia. Interestingly, though, Lecomte (2007 p.301) has observed that there is only one Parthian period site in Dehistan with material comparable to that of the Gorgan Plain; however, he notes that we simply may not be recognising what constitutes 'Parthian' material in this region. Again, as the ceramics from Tureng Tappeh suggest, there is a gradual evolution of the ceramics from period V A through V B and V C meaning that it is difficult to identify a single 'Parthian' assemblage. The similarities between the ceramics of V C final – V D and the subsequent levels of the Sasanian Fort at Tureng Tappeh, also indicate a gradual transition to the Sasanian period, further complicating attempts to make clear divisions.

In terms of interregional connections, significant variation in ceramic assemblages across the Sasanian Empire has been observed, making it difficult to define an overall 'Sasanian' package of material culture (Huff 1986 p.309; Mousavi and Daryaee 2012 p.1078, 1092; Priestman 2013 p.530). However, at least from the Achaemenid period, there is little doubt as to the connectivity of these regions with other parts of these empires, but local traditions (at least in material culture) seem to be influential, and regionalism is considerable.

4.3 CHRONOLOGICAL RESOLUTION OF INDIVIDUAL SURVEYS

A major component of this study is the integration data gathered through the *Gorgan Wall/Persia* Projects, with published survey data into a database. As discussed in Chapter 3, this is not without its difficulties, and disparate assessments have been made of the same site. In particular, the continuity in ceramic wares/forms that has been observed in the above discussion can affects one's ability to interpret the ceramic material collected during survey. However, this exercise has been useful in highlighting problem phases within the chronology. The chronological reliability of the data from each of the surveys used and how this affects our interpretations of settlement patterns on the Gorgan Plain is discussed below.

4.3.1 THE SWEDISH SURVEY (ARNE 1945)

Arne (1945) provides information about pottery types, and relative dating for both the excavations at Shah Tappeh, and by extension the survey of the Gorgan Plain. A reassessment of the excavations by Orsaria (1995) has resulted in a relatively well dated sequence for the prehistoric periods. However, settlement ceased on Shah Tappeh around the beginning of the 2nd millennium, and did not have resume until the Islamic period.

As the survey relied on comparisons to the excavated material, occupation between the Iron Age and Sasanian periods was not identified in the survey. His discussion of the Gorgan Wall and its pottery clearly indicates little understanding of Sasanian pottery at the time of the survey.

> "While broken pottery was commonly observed on the tepés, practically none was seen, and least of all any Sassanian pottery, in Qyzyl-Alan except at the westernmost point near Gumūš Tepé. The brick, on the other hand, seemed to be of the same kinds as that which was found in the early Mussulman layers in Shah Tepe. There is thus not yet any archaeological proof that this wall goes back to Anūširvān's time, the 6th century" (Arne 1945 p.11).

In the site catalogue the pottery information for many sites simply states its presence or absence. For some of the surveyed sites no period designation is given, but pottery types are indicated. The exception is what he describes as "mussulman" pottery, indicating Islamic pottery.

The only ware-type for which he gives specific site information is what he calls the black on red slip ware with geometric designs (Found on Shah Tappeh, 4, 8, 35, 39, 41, 52, 62, 65, 66, 80, 83, 86, 88, 93, 94, 97, 125, DK 1, K.D., Gumustappeh, Tureng tappeh, Hadji Kara (Aga). These are Neolithic, Chalcolithic or perhaps even Early Bronze Age painted wares, parallels which he found in the lowest levels of Shah Tappeh (III). In this case, it was clear that these sites had a prehistoric component.

His explanation of the pottery types found on survey is as follow:

> "The *mussulman* sherds here mentioned, are generally glazed. The *painted sherds* are prehistoric, mostly black-on-red. More than a dozen tepés show unglazed mussulman pottery of brick-red ware, but there is also red polished and coarse ware from the same epoch. Of the prehistoris [sic] pottery the majority is black or grey, but we have also red polished ware, coarse ware, mottled ware and finally a polished thin ware, partly red, partly grey" (Arne 1945 p.30).

The above summary clearly indicates a wide range of pottery types ranging from the Neolithic/Chalcolithic through to the Islamic period. Interestingly, he describes a category of pottery, found on ten sites, that is thin-walled, well fired, appears to be from open forms, with a "red, generally profiled rim-part, and often and sharply delimited against this a continuation both inside and outside in grey…. perhaps a trifle flamy"; this fits the description of the bichrome wares associated with Parthian period. However, there is no indication on which sites this pottery was found. The dating information given in this survey is most useful in comparison to dating information from other surveys.

4.3.2 HIROSHIMA UNIVERSITY SURVEYS OF THE 1970S (SHIOMI 1976, 1978)

As part of the larger Hiroshima Scientific Expedition to Iran several surveys were carried out in the Gorgan Plain between 1974 and 1976 (Shiomi 1976; Shiomi 1978). Also several small excavations were carried out at Tappeh Anjirab, Tappeh Gorbag and Tappeh Hoseynabad. Reanalysis of the material from Tappeh Hoseynabad has recently been undertaken, but due to time constraints and the volume of material, the ceramics collected from the surveys are still to be assessed (Ohtsu et al. 2010 p.133).

No period designations were given to the sites; however, pottery types were sometimes mentioned. While generally not descriptive enough to be of use, references to several types i.e. painted pottery, or red-brown polished pottery may be suggestive of particular periods. This information is most useful when it can be compared with chronological data for the same site in another survey.

4.3.3 SURVEY OF THE GORGAN PLAIN BY KIANI (1982)

The chronology developed during the survey and excavations of M.Y. Kiani (1982b) identified pottery from five phases - the prehistoric, Achaemenid, Parthian, Sasanian and Islamic periods. The pottery types he identified for each of these periods during the survey are summarised in Table 4-2. Sites in the survey designated as prehistoric were identified by the presence of grey wares or black or red painted wares comparable to Shah Tappeh, Tureng Tappeh and Yarim Tappeh. Information on which sites contained which wares is often lacking and some of the dates he assigns to each phase are now known to be incorrect. However, as the prehistoric period is not the focus of the current study, this data was not investigated further.

Of greater interest is his assessment of the ceramics of what he deemed the Achaemenid period through Sasanian periods. Achaemenid pottery is described as grey and red with forms including rhytons, and zoomorphic vessels. Grey wares are said to be most common and frequently burnished. While he indicates that parallels for this assemblage can be found at Tureng Tappeh in period V A, the predominance of grey wares, and his mention of tripod bases (see Kiani 1982b Fig. 17, 18) suggest that he may have conflated ceramics from the Iron III and/or IV period. His description of grey wares of the Parthian period includes bowls, pitchers, jugs and 'teapots' for which he finds parallels in Tureng Tappeh V C, Yarim Tappeh 1-4 and at Shahr-i Qumis, but for example several of the 'Parthian' grey ware forms from Qal'eh Yasaqi (GWS_35) (see Kiani 1982b Fig. 49) again resemble forms from the Iron III period. Taking all this into account it seems likely that the pottery classified as Parthian grey ware is a conflation of grey wares from multiple periods (see Kiani 1982b Plate 39.1, Fig. 45, 47 and 49).

His description of Parthian red wares includes two categories, a fine red ware that includes burnished red wares and 'clinky' open forms, and a second category of mainly closed forms in a hard red paste. The former category appears to include both burnished red wares and bichrome wares (see Besenval 1987; Haerinck 1983). While extending into the Parthian period, the burnished red wares are also found in earlier contexts such as at Tureng Tappeh V A, associated with the Achaemenid period (Cleuziou 1985 Fig. 24). The excavators of Tureng Tappeh have also pointed out that some of the forms identified as Parthian red wares in Kiani's excavations are similar to ceramics from Tureng Tappeh VI A and may in fact also be characteristic of the earlier Sasanian period (Boucharlat and Lecomte 1987 p.118).

Kiani (1982b p.64) also identified three types of Sasanian wares; glazed wares, simple red wares and incised red wares. His identification of incised red wares as middle Sasanian is relatively accurate and comparable to REDPLI in the assemblage at Fort 4 (FORT_8) excavated by the *GWP* as noted by Priestman (2013 p.528). The glazed wares may be Sasanian, but are more likely to be Islamic[12]. Overall, there is are inconsistencies in Kiani's classification. As in our own survey and those of our Iranian colleagues (see below), the ceramic chronology for the later Iron Age through early Sasanian periods requires further clarification. However, the inclusion in his publication of the ceramic drawings for some of

[12] Limited examples of glazed wares were found in *GWP* excavations (Priestman 2013: 457-459).

the excavated and surveyed sites means that comparisons to chronological assessments from other surveys can be made for individual sites.

4.3.4 SITE ASSESSMENTS OF THE ICHHTO (ABBASI 2011)

While archaeological projects by foreign teams have been limited over the last 35 years, Iranian colleagues from the ICHHTO have continued to carry out an immense amount of work on the archaeology of the region. This includes visits to and brief assessments of hundreds of sites recorded previously by numerous surveys and recently published as an appendix to the excavations at the site of Narges Tappeh (Abbasi 2011). The dating of individual sites is difficult to evaluate without publication of the ceramics, though the information they provide on the sources used to identify key ceramic horizons is helpful (Abbasi 2011 p.200). Along with comparisons to several Iranian surveys not accessible in English, they also draw clear parallels to relatively well-known material from Tureng Tappeh (Iron III/IV, Parthian), Yarim Tappeh (Iron Age III/IV, Parthian), Narges Tappeh (Iron Age III/IV, Parthian, Islamic), Jurjan (Islamic) as well as the excavations of the *GWP* (Sasanian).

Of particular interest to this study are of course sites dating between the Iron Age and the Sasanian period. No sites have been designated as Iron I or II; this is not surprising given our current lack of understanding of the ceramics of these periods on the Gorgan Plain. Sites dating to the Iron III/IV, Achaemenid and Parthian periods are much better represented, however, the sequence between the Iron III and the middle Sasanian period has very few absolute dates, and a small body of comparative material. The maps published in Abbasi's (2011) volume have been divided by period into Iron III/IV, Achaemenid and Parthian periods. Two issues in teasing out detailed chronological data therefore exist. First, the Iron III and IV periods are conflated. Secondly, there is potentially significant overlap between the Iron IV, Achaemenid and Parthian periods, creating a similar problem to the one experienced in the analysis of the *GWS* sample (discussed below).

4.3.5 THE WORKING CHRONOLOGY OF THE GORGAN WALL PROJECT AND THE PERSIA PROJECT

Excavations undertaken by the Gorgan Wall Project have provided us with several absolutely dated and well-studied, though chronologically limited, assemblages representing the Iron III (8th to 5th centuries BC) and the mid to late Sasanian periods (5th to 7th centuries AD) (Priestman 2013 Table 18:1; see discussion earlier in this chapter). This however, has left a significant gap, of at least a millennium for which our knowledge of the ceramic chronology is less precise.

During the *GWS* sites were generally assigned a spot date in the field. In the 2009 season, all the samples from sites that had been surveyed in the previous seasons (2005 to 2008) underwent a laboratory assessment by our pottery expert Seth Priestman and the author. Because our understanding of the ceramics had moved forward considerably from the first to the last season, specific markers associated with the Iron III, or the mid to late Sasanian period were easily recognized. Equally, we began to recognise pottery associated with a phase of settlement that post-dated that of Qelich Qoineq (GWS_16) but clearly pre-dated that of Qal'eh Kharabeh (GWS_1) and Fort 4 (FORT_8). This included elements of the Iron III assemblage, notably the tripod bowl (B4), in association with types such as flared-neck jars with offset rims called J9, a type of jar with a flared rim rolled over at the lip (often rounded, but variations may exist) identified as J10, beaded rim jars and bowls, and carinated bowls with an "S" shaped profile (Priestman 2013 p.524; Priestman pers. comm. April 2016; Wilkinson et al. 2013 p.113–120). Some of these forms find parallels at Tureng Tappeh in phases V A - VI A (Boucharlat and Lecomte 1987 Plate 50-51; Deshayes 1979 Fig. 3; Cleuziou 1985 p.184, Fig. 24, no. 3-4). As such the evidence points to the gradual evolution of some forms between the Iron III and IV periods, alongside the introduction of new ones in Iron IV.

This post Qelich Qoineq phase was tentatively called Iron IV and within our working chronology encompasses a period between roughly 550/400 BC and 150 BC (post Qelich Qoineq to the Early Parthian period). This admittedly long phase clearly needs further refinement, and likely overlaps with phases defined as Achaemenid or Parthian at other sites. In order to enable comparability with other datasets, forms associated with the Achaemenid or Parthian periods in other datasets were also noted; this included, for example, markers like the fine bichrome wares called *céramique à bord contraste* and *céramique flammée* at Tureng Tappeh (found in particularly high quantities in period V B-V C and attributed to the Parthian period). However, the long evolution of the *céramique sonore* forms (of which the *céramique à bord contraste* and *céramique flammée* types are two) from the later Iron Age or Achaemenid period (*GWS* Iron IV) to the Parthian period

(Cleuziou 1985 p. 182; Deshayes 1973; Haerinck 1983 p. 198) can make it difficult to assign periodisations based on the presence of these wares alone. Equally, the use of these terms suggests that changes in the ceramic assemblage went hand in hand with political change, a dangerous assumption.

While preliminary, a working chronology for the Iron Age through Sasanian period (included in Table 4-1), based on that developed by Priestman (2013: p. 512) and supplemented with comparative data from Boucharlat and Lecomte (1987) and Kohl (1982), allows us to begin to trace the development of settlement systems from the Later Iron Age through to the periods associated with historical empires (Achaemenid through Sasanian) from a local and regional perspective. The use of the Iron I through IV divisions is based on chronologies developed for western Iran (Levine 1987), which has been adapted by our Iranian colleagues in their excavations of the region (Priestman 2013 p. 512).

Furthermore, grey wares likely representing the Bronze Age and comparable to excavated wares from Shah Tappeh (Arne 1945) and Narges Tappeh (Abbasi 2011) were recognised at surveyed sites, and in excavations at Dasht Qal'eh (GWS_54) (Priestman 2013 p. 521). However, due to the chronological limitations of the project no attempt was made to refine this chronology, and only the presence of such wares was noted.

4.4 SUMMARY

It is clear, due to the limited chronological information associated with the individual survey datasets, that the sum is greater than the individual parts. On their own, the older survey datasets (i.e. Arne 1945; Kiani 1982b; Shiomi 1976, 1978), due to the lack of detailed chronological information, would not be much use in establishing periods of occupation at individual sites. However, when taken together, and compared to the period assessments made by the *GWS* (Wilkinson et al. 2013) or the *ICCHTO* surveys (Abbasi 2011) (though both of these are also not without issues), we can begin to see trends even in these broad descriptions (i.e. red-brown polished pottery in the Shiomi (1976; 1978) datasets appears to correlate to sites with likely Iron Age III or later occupation), and the sometimes detailed information for individual sites (i.e. the Kiani (1982b) dataset) can help us refine current assessments. Furthermore, the database constructed for this study can be supplemented as the results of both further explorations, and the restudy of legacy data are made available.

With an understanding of the long-term ceramic chronology of the region in mind, the following chapter will present a broad overview of archaeological and historical settlement and land use patterns on the Gorgan Plain. Furthermore, it will consider how both the natural environment and cultural activities have affected these patterns, and our reading of earlier landscapes.

5 THE LANDSCAPES OF THE GORGAN PLAIN

This chapter describes the physical landscapes of the Gorgan plain, and provide an overview of historical and modern land use. This can help us understand the processes that have resulted in the archaeological landscapes that are visible today, and the factors that may affect the interpretations of the archaeological record made through field survey and remote sensing. Finally, I will provide a brief overview of the long-term settlement trends apparent in the *GWS* field survey dataset, and compare that to the broad trends visible in other datasets. This will set the stage for a more in-depth analysis of trends, incorporating the data from remote sensing, within several chronological windows in Chapters 6 and 7.

5.1 GEOGRAPHY AND ENVIRONMENT

The boundaries of the Gorgan Plain are defined by the arc of the Alborz Mountains in the south and east, the lower Atrak River in the north and the Caspian Sea in the west. While the Atrak has been taken as the northern boundary for this study, geographically the same flat arid plain continues north into Turkmenistan, encompassing the region known historically as Dehistan and the Misrian Plain (Kohl et al. 1982 p.3; Le Strange 1905). To the south, the Alborz Mountains rise dramatically, and steeply from the near flat plain to over 3000 m in height. While not impassable they form a significant barrier, and traffic between the Gorgan Plain and the Iranian Plateau, both today and in the past, is restricted through a few narrow defiles (Fisher 1968 p.38). Covering such a large area with diverse topography, the region is characterised by a variety of environmental zones. The greenness of the Alborz Mountains and the piedmont zone give way to a vast plain, increasing in dryness as one moves north. The long-term settlement history of the region seems to reflect maximum urban and rural settlement density and investment in agriculture in areas immediately north of the Alborz foothills, diminishing gradually in intensity as one moves towards the Gorgan River. Corresponding to this general trend is an increasing reliance on pastoral economies, as one moves north, especially between the Gorgan and Atrak Rivers. The interface between agricultural and pastoral, sedentary and mobile land use and settlement was however constantly in flux, resulting in periods of significant investment in agriculture in the steppe, and inversely periods where less intensive agro-pastoral subsistence strategies were dominant resulting in distinct landscape signatures.

5.1.1 GEOMORPHOLOGY

Extending from the mountains, loess hills intrude into the plain from the northeast between the Atrak and Gorgan Rivers. Below these hills to the north, west and south are alluvial fans and lowlands that cover more than half the plain. Alluvial coastal lowlands and piedmont plains are found along the base of the northern slopes of the Alborz from south of Gonbad-e Kabus to Gorgan, and cover much of the western plains along the Caspian coastline. Areas of salty mudflats and solontchaks[13] are found within the alluvial plains to the north of the Gorgan River and along the eastern Caspian Coast near the Atrak River (Busche et al. 1990) (Fig. 5-1).

The soils of the Gorgan and Atrak alluvial plains are therefore dominated by loess-derived alluvium and the depth of alluvial deposits (between c. 17m and 40m in most areas, but greater depths have been recorded) is related to their proximity to rivers that move the sediment into the plains (Frechen et al. 2009 p.221; Khormali and Kehl 2011 p.110; Wilkinson et al. 2013 p.29–30). It has been suggested that much of these alluvial deposits were laid down prior to the earliest levels of many of the tappehs or ancient mounded sites on the plain (Keraudren and Thibault 1973).

5.1.2 CLIMATE AND WATER RESOURCES

Rainfall averages c. 800 – 1000 mm per annum in the Alborz and the foothills and falls mainly between December and April; in the high Alborz annual rainfall can exceed 1200 mm per annum and is more evenly spread throughout the year. Rainfall decreases significantly to c. 200mm per year as one moves north into the steppe and nears the southern banks of the Atrak River (Kehl 2009 p.2; Khormali and Kehl 2011 p.111; Van de Weg et al. 1968) (Fig. 5-2). Monthly mean daily temperatures for both Gorgan and Gonbad-e Kavus throughout the year range between c. 8° C and 30° C (Kehl 2009 Fig. 1, Table 1). While the high rainfall makes this foothills and plains extending from the north face of the Alborz incredibly fertile, flash floods can also occur in winter and spring that wreak havoc on agricultural systems (Carey and Carey 1976 p.361).

[13] Soils with high salinity within 50 cm of the surface; they are often found in arid and semi-arid climates and in coastal environments.

The rivers of the plain are extremely active, deeply incised and can prove difficult to cross (Fisher 1968 p.53). Evidence for relict meanders and palaeochannels are especially apparent on the CORONA imagery (see Fig. 3-8). The Gorgan River dissects the plain from east to west. The evidence for changing river channels in the Gorgan Plain was discussed in Wilkinson et al. (2013 p.30–32). Data from remote sensing and field visits were used to outline four broad stages in the life of the Gorgan River in the western plain, perhaps ranging from the Late Quaternary to the present day. These stages are briefly summarized in Table 6-8 and will be described in more detail later on in relation to sub-regions of the plain, and archaeological sites and landscape features (see also Figs. 6-7 and 6-8).

Changes in the course of the river are produced by a number of factors that include rainfall, and the levels of the Caspian Sea (see below). In the east the course of the river appears to have changed far less than in the west as attested by the association that can be made between Sasanian period features and the current course of the river (Wilkinson et al. 2013 p.69–80), as well as descriptions of the rivers course from Islamic period texts describing the river flowing through Jurjan (near modern Gonbad-e Kabus) (Le Strange 1905 p.376).

A recent study of multiproxy environmental data has provided insights in the palaeoclimatic conditions of the plain over the last 6000 years (Shumilovskikh et al. 2016). The landscape near the core (north of the Alborz Mountains, but south of the Gorgan River) appears to have been mainly steppe (though the conditions fluctuate between moist and dry over time). Drier conditions appear to have prevailed between 5.9 and 3.9 ka, while wetter conditions beginning around c. 4 ka BP, and the moistest conditions beginning c. 2.8 ka. Human impact on the environment is visible for the last 2.7 ka, but appears to be the most significant between c. 2 and 0.7 ka corresponding to the period of the territorial empires. The relationship between these events and settlement and land use on the plain will be discussed in more detail in later chapters.

5.1.3 VEGETATION AND LAND COVER

The vegetation of the region ranges from dense forest in the Alborz mountains to steppe vegetation on the plains to the north (Fig. 5-3). Hyrcanian forest is found along the southern shore of the Caspian and in the northern foothills of the Alborz Mountains; this is humid forest characterised by deciduous trees, and some evergreens. There are three zones - the lowland forest up to c. 700 m characterised by chestnut-leaved oak, common hornbeam and ironwood among other species, the lower montane zone between c. 700 to 1500m where beech trees are the most abundant, and the upper montane zone c. 1500 m to the treeline dominated by oak, hornbeam, along with elm, ash, maple, and shrubs like juniper. This region receives high rainfall and is often covered in mist. Much of the lowland forest has been destroyed as well as a good deal of the lower montane zone (Fisher 1968 p.285; Leroy et al. 2011 p.420; Sagheb-Talebi et al. 2014 p.26).

Immediately to the north of the forest zone is a roughly parallel strip of cultivated land (roughly running from the Caspian Coast to Gonbad-e Kavus). In the western plain, the area north of the cultivated zone, up to the border with Turkmenistan, is characterised by herbaceous and semi-woody salt-swamps. In the eastern plain, to the north of the cultivated zone, xeromorphic (plants adapted to withstanding drought) shrubs and trees dominate (Frey et al. 1989).

Historical and archaeological evidence suggests that there has been some variation in the boundary of the forested region. The map of archaeological sites produced by T.J. Arne (1945 p.15) and colleagues in the 1930s indicates a forested zone that extends several kilometres farther into the plain than it does today, and that many tappehs could not at that time be recorded because of the tree cover. Early European travellers in the region also attest to the forest zone extending at least this far or further into the plain in the 19th century AD (Napier and Ahmad 1876 p.133; O'Donovan 1882 p.162–163). Wilkinson et al. (2013 p.38) have pointed out that while the plains extending from the foothills of the Alborz were forested in the 19th and early 20th century AD, tappehs are more likely to have formed in open areas. This suggests that the forest had likely been cleared further into the foothills in a previous period. Comparisons of the CORONA imagery and imagery available on Google Earth also show that significant deforestation has continued to occur in the 20th century AD. However, pollen and insect evidence from the Kongor Lake core, over 10 km to the north of the foothills in the eastern end of the plain, indicate that the Hyrcanian forests likely did not reach this far north over the last c. 6000 years (Shumilovskikh et al. 2016).

5.1.4 THE CASPIAN SEA

The levels of the Caspian Sea have changed dramatically over thousands of years and this dynamism has had an impact on both settlement and land use patterns and the preservation of archaeological features in the region. The Caspian Sea is not connected to any ocean, and is in fact the world's largest lake. The sea is divided into three basins – the north, middle and south - by underwater shelves creating shallow areas. The south basin which is bordered by Iran and much of Turkmenistan on the southern and eastern shoreline is the deepest section of the sea (1025m) and holds over half of the water in the Caspian Sea (Kakroodi et al. 2012 p.94; Kakroodi et al. 2012 p.94; Kaplin and Selivanov 1995 p.163). The sea level is affected by runoff from rivers, particularly the Volga in the north and the Sefidrud and Kura in the south, the amount of precipitation received, and the amount of evaporation especially through Kara-Bogaz-Gol Bay (Kaplin and Selivanov 1995 p.164; Leroy et al. 2011 p.416). Currently, the Volga River contributes 80% of the water flowing into the sea (Dumont 1998 p.44; Kroonenberg et al. 2007).

That the level of the Caspian Sea has changed considerably over time is not in doubt, though exact consensus on the timing of such events has not been reached (Kakroodi et al. 2012; Karpychev 2001; Kroonenberg et al. 2007; Lahijani et al. 2009; Rychagov 1997 p.4). The dynamic nature of the sea is also indicated in historical sources; transgressions were recorded in the 14th, 17th/18th and early 19th century AD (Dumont 1998 p.45; Kakroodi et al. 2012; Lahijani et al. 2009; Le Strange 1905 p.741; Sauer et al. 2013 p.152). GAMBIT imagery taken in 1966 shows linear features likely representing relict Caspian shorelines. While difficult to correlate to the dated transgressions or historical events mentioned above, these features can provide an understanding of how far inland some of these transgressions reached. At least six relict coastlines are visible; the westernmost is nearly 13 km from the coastline as it was in 1966 and nearly 10 km from the modern coastline (see Hopper and Omrani Rekavandi in press).

More detailed reviews of the current evidence relating to Sasanian period activity, and mobile pastoral land use along the coast can be found in recent publications (Hopper and Omrani Rekavandi in press; Wilkinson et al. 2013 p.33–36). Overall, the Caspian shoreline appears to be sparsely occupied through time. This could be due to the natural conditions near to the Caspian Sea; the saline soils and marshy conditions are less attractive for either settlement or cultivation (Fisher 1968 p.52). Baron de Bode (1848 p.61) observed that the lower reaches of the Gorgan and Atrak Rivers often overflowed in spring forming marshy conditions which bred masses of insects in the hot summer, while T.J. Arne (1935 p.14) indicates "In the westernmost parts of the steppe there are scarcely a tumuli". However, this lack of archaeological features may also be a consequence of transgressions of the Caspian Sea in more recent times.

The limit of known prehistoric settlement along the coast, in all but one case, is located significantly farther east than even the end of the Gorgan Wall (Abbasi 2011; Arne 1945; Wilkinson et al. 2013). This could suggest that the coastline was still further inland at some point in the prehistoric periods, a theory hinted at by evidence of a transgression from a core nearly 20 km inland from the modern coastline dated to the 5th millennium BC (Kakroodi et al. 2012). A large body of data also suggests a high stand in the 1st millennium BC (Kakroodi et al. 2012; Karpychev 2001; Kroonenberg et al. 2007; Lahijani et al. 2009; Rychagov 1997). As such, it is difficult to say whether the distribution of settlement in the western Gorgan Plain in the Later Iron Age through Parthian period (Abbasi 2011; Wilkinson et al. 2013) is reflective of a contemporary coastline or whether a later transgression is responsible for the pattern. The Sasanian period falls comfortably into a period of low sea level known as the Derbent Regression; this is supported by the existence of the end of the Tammishe Wall below current sea level (Wilkinson et al. 2013 p.35) and the possibility that the western limit of the Gorgan Wall may now be under water. At the least, the end of the Gorgan Wall was clearly submerged by a transgression of the Middle Ages that extended further east than the current coastline (Sauer et al. 2013 p.149–154). This transgression(s) is clearly mentioned in historical sources.

5.2 ARCHAEOLOGICAL, HISTORICAL AND MODERN LAND USE PATTERNS

The cultural landscape of the Gorgan Plain that we see today is the result of thousands of years of human use and reuse, action and reaction that has resulted in the addition of certain features, and the complete or partial subtraction of others; therefore, the complete recovery of any one landscape (belonging to a particular period of time) is unlikely. The term landscape taphonomy has been used to describe our understanding of the processes that can affect the completeness of the landscape; this includes physical and cultural transformations, as well as political, social and economic factors (Wilkinson 2003 p.8). As such, an understanding of archaeological, historical and modern land use, and the social, political and economic influences behind it, needs to be coupled with data on physical processes (e.g. sea level change) to understand how and why certain past landscape features survive better than others, and how representative they are of any one complete landscape. The following section discusses how 20th century AD land use has influenced our reading of the archaeological record, review historical evidence for land use and settlement on the plain from the Islamic period to the 19th century AD, and present a broad overview of settlement development on the plain from the Neolithic through to the Sasanian period from the currently available data.

5.2.1 20TH CENTURY AD LAND USE

Reza Shah's forced sedentarisation of mobile pastoral groups in the 1920s and 30s and the subsequent introduction of extensive agriculture using modern techniques brought about significant changes to land use regimes in the region. Under Reza Shah "the construction of qanats was advanced; the reclamation of marsh and pasture lands was promoted; the cultivation of cash crops, in particular cotton and tobacco, was forced upon the peasants" (Okazaki 1968 p.8). Much of the land, beyond the immediate foothills of the Alborz, had been for several hundred years previously the domain of Turkmen tribes, engaged in pastoralism and cultivation. These groups raided and traded with (and sometime exerted considerable power over) sedentary communities, and used their mobility to resist government control until the 20th century AD (Irons 1969 p.34–35).

While much reduced in numbers by the mid-20th century AD, Turkmen tribes engaged in a variety of agropastoral strategies were still present on the plain, and the Yomut branch were documented in detail by Irons (1969; 1971; 1972; 1974). Inhabiting the Gokcha Hills in the eastern Gorgan Plain, the Yomut Turkmen were divided into a pastoral (*charwa*) and an agricultural segment (*chomur*). The *charwa*, mainly herded sheep and goats, as well as horses, cows and camels, with variation in herd composition reflecting differences in environmental zones. They also engaged in high-risk dry farming on a small scale, as a secondary activity (Irons 1972 p.89). The *chomur* on the other hand, were mainly engaged in dry farming with the raising of sheep and goats taking the subsidiary role; while more sedentary than the *charwa*, they still retained a degree of mobility and a tribal identity (Irons 1971 p.144–145; Irons 1972 p.100).

In terms of land use, the *chomur* inhabited the region both south and immediately north of the Gorgan River, where dry farming is easily undertaken. The *charwa* lived to the north of this in the more arid regions (that is roughly, north of the Gorgan River) (Irons 1972 p.100). The *charwa* moved seasonally, camping near a permanent water source in the dry season, but moving out into the landscape during the wet season. The animals were grazed near the camp in the wet season (because of lambing and milking), but were moved south to graze near the banks of the Gorgan River in the dry season (often on stubble fields) (Irons 1969 p.29–30).

However, these patterns were a thing of the past by the 1950s when mechanized farming and modern irrigation resulted in agricultural intensification and extensification across the plain (Fisher 1968 p.53; Okazaki 1968 p.6–9, 22). Considerable amounts of pasture and grazing land in fertile areas was converted to crops (Okazaki 1968 p.36). Migration to the region for economic reasons, the settlement of many mobile pastoral groups and general population growth accompanied these changes and resulted in considerable increases in sedentary village and town based populations in the region. The population of Astrabad (modern Gorgan) increased nearly fivefold between 1900 and 1956, and nearly doubled again by 1966 (Bharier 1972).

Large swathes of the Gorgan steppe are suitable for the dry farming of wheat and barley, and between the 1960s and 1970s, the Gorgan Plain became one of the main wheat and barley producing regions in Iran. While cultivated for a long time in the area, cotton and cotton-seed for oil, also became important cash-crops (Carey and Carey 1976 p.370–372) between 1957 and 1961 for example the amount of land used for growing cotton increased substantially (Okazaki 1968 p.19). Cotton (often in combination with wheat) was cultivated in the alluvial and piedmont plains between Gomishan and Gonbad-e Kavus, and from the foothills of the Alborz to just north of the Gorgan River (Van de Weg et al. 1968).

The area under irrigation increased substantially in size, amplifying yields considerably (Okazaki 1968 p.22). Interestingly, the most intensely irrigated areas, on land use maps of the 1960s, were those that receive high amounts of rainfall (300 – 600 mm per annum) indicating intensive production. However, the density of cultivation appeared to have thinned as one approached the Gorgan River, where it was limited to areas that could be irrigated by wells or river waters and become more intermixed with grazing lands. East and north of Gonbad-e Kavus, where the loess hills intrude, further alluvial plains are found, but because of decreasing rainfall the natural vegetation is steppic. Precipitation is sufficient (300mm a year) to undertake some dry farming, however, yields are improved by irrigation. These areas were also used for grazing (See Figs. 5-1 to 5-3)

Along the shores of the Caspian, especially north of Gomishan, grazing appears to have been predominant up to the 1960s, with a minimal amount of dry farming also practised.

The geomorphology of this area is heavily influenced by proximity to the Caspian Sea. The immediate coastal area (c. 2-4 km in width) from Kordkuy in the south up to the border with Turkmenistan is dominated by coastal salt flats and marshes. Moving eastward into the interfluve between the Atrak and Gorgan rivers steppic vegetation adapted to saline environments (i.e. Salicornia) is predominant. High soil salinity is highest near the Caspian Sea, decreasing somewhat as one moves east toward the loess hills north east of Gonbad-e Kavus. Not surprisingly there is a high correlation between soil salinity and areas classed as waste or grazing land.

The slopes of the Alborz are forested, and land use of the mid-20th consisted of local grazing and wheat cultivation in cleared areas. All along the southern Caspian coast, Fisher (1968 p.59) describes a system in which different altitudes are utilized in different seasons for grazing and cultivation; with villages on the slower slopes as a base, herds were moved up into the mountains for summer, and down to the plains in the winter, but this practice appeared to be decreasing from the 1930s. However, Wilkinson et al. (2013 p.37) noted the use of summer upland pasture in the Eastern Alborz near Qal'eh Maran (GWS_51) in the previous ten years. The Alborz foothills and the mountains also provided a useful source of wood. The improvement in transportation routes from the 1930s, led to an increase in the production of wood for sale in Tehran, and by the 1960s much of the accessible forest had been cleared (Fisher 1968 p.59)[14].

To illustrate the rapid changes that took place in land use between the early and later 20th century AD, Fig. 5-4 shows the relationship between ecological zones and dominant modes of economic production prior to 1950 as defined by Irons (1974 Fig. 1), and the modern limits of irrigated agriculture illustrated by a CIR (colour infrared) Landsat image. While simplifying a complex picture, Irons defined three zones: the zone immediately to the north of the Alborz Mountains representing the core intensive agricultural area (A); the zone of 'extensive agriculture' extending north of zone A into the steppe (B), which equates with the area that was mainly dry farmed by the *chomur* segments of various Turkmen groups, and; the 'steppe-desert' zone (C) extending from zone B up toward the Atrak River and

[14] This is also apparent when comparing Arne's (1945 Fig. 3) archaeological map of the region in the 1930s, in which the forested areas extends several miles north of Astrabad (modern Gorgan city) and the maps derived from the egional Map of Land Resources and Potentialities: Gorgan Region – East Mazanderan 1968.

which was predominantly being utilised for grazing and the seasonal movement of the *charwa*.

If these zones are compared to the maps (see Fig. 5-3) based on the 'Regional Map of Land Resources and Potentialities: Gorgan Region – East Mazandaran 1968', there is a significant increase in the area under intensive (and irrigation agriculture) over the space of only a few decades. Furthermore, since the 1960s, areas under cultivation have continued to creep northwards. This is clear on the CIR Landsat mosaic used as a base map for Fig. 5-4. The image is composed of two tiles taken in July of two consecutive years (2000 and 2001) producing some difference in the colour of the vegetation probably attributable to rainfall and vegetation growth rates of specific years. Healthy vegetation appears red; coniferous vegetation is dark red, while broad leaf and vigorously growing vegetation are bright red. Light red areas represent grasslands or more sparsely vegetated areas. The densely forested Alborz Mountains are apparent, and represented by an almost solid blanket of deep and bright reds. Moving north into the foothills a patchwork of bright red vegetation (clearly arranged into field systems representative of intensive agricultural practices). It is noticeable that the density and vibrancy of the vegetation decreases as one approaches the Gorgan River. The core cultivated (and irrigated) areas are still concentrated in the southern plain, but complexes of irrigated fields are also visible in the central plain immediately north of the Gorgan River. Modern studies of land use indicate that principal crops include wheat, barley, sunflower, watermelon, rice and cotton (Saadat et al. 2011 p.609).

Over the course of the 20th century AD significant changes in agricultural and pastoral practices have occurred. Sedentarisation of mobile groups, migration, and the introduction of mechanised agriculture have resulted in an increasing amount of area being dedicated to intensive irrigated agriculture. Deeper ploughing, irrigation, and modern development (roads, factories, urban expansion) have had the most profound impact in the southern half of the plain and have resulted in the ongoing attenuation of the archaeological evidence. However, the comparably less intensive investment to the north of the Gorgan River, until very recently, means that the survival of earlier landscapes is far more likely in this sub-zone.

5.2.2 HISTORICAL LAND USE

The agricultural potential of the Gorgan Plain is mentioned as early as the 1st century BC in Strabo's Geography:

> "Hyrcania is very fertile, and extensive, consisting for the most part of plains, and has considerable cities dispersed throughout it….The following facts are narrated as indications of the fertility of the country. The vine produces a metretes of wine; the fig-tree sixty medimni of fruit; the corn grows from the seed which falls out of the stalk; bees make their hives in the trees, and honey drops from among the leaves" (Strabo 1917, 7.2).

Accounts from the 10th century AD praise the district of Jurjan (modern Gonbad-e Kabus) for the volume of its produce, its rivers, and gardens, but decry its climate as too hot and complain the water is bad. Citrus fruits, pomegranates, olives, watermelons, aubergines, jujube and grapes are grown, and silk is produced. A better climate and water is said to be found in Astrabad (modern Gorgan city) where the principal industry is weaving raw silk, which is exported from the nearby port of Abaskun (Muqaddasi 2001 p.290–91; Le Strange 1905 p.377–379; Ibn Hawqal 1800 p.179–180). Al-Muqaddasi (2001 p.215–216) referencing an earlier author also gives an account of Jurjan said to come from a Sasanian king; in it Jurjan is mentioned as one of the most pestilent places in the Islamic world but also as having "the finest reservoirs" making reference to its water resources.

The interface between cultivated and grazing lands is also described by al-Tabari, also writing in the 10th century AD. Of a trip along the banks of the Gorgan River he says: "We travelled along, with the pastoralists' tents of Jurjān on one side, and the gardens and orchards on the other" (al-Tabari 1989 p.59). This passage suggests that areas under intensive (as opposed to extensive) cultivation extended to near Jurjan, while more permanent grazing areas were likely found to the north of the river. A similar picture, with grazing to the north of the river and agriculture dominating to the south, appears to have been maintained in the Seljuk period (1037-1194) (Christensen 1993 p.161).

The region, including the city of Jurjan, was devastated by the Mongol invasions in the 13th century AD and by Timur and his armies at the end of the 14th century AD. Mustawfi writing in the 14th century AD indicates that Jurjan (the town) never built itself back up to the same level after the Mongol invasion, but he still mentions the quality of the fruit from the region (Le Strange 1905 p.376–378). Equally, while periods of devastation are mentioned, periods of prosperity also existed; for example, under the Timurids silk was being produced in the Caspian provinces, and the produce of Astrabad (mostly citrus fruits) was still praised (Aka 1996 p.14, 17, 19–20).

In the Safavid period (AD 1501-1722) an overall similar pattern of land use as in the earlier Islamic period appears to have been maintained, with the core agricultural zone (and zone of sedentary settlement) concentrated around towns such as Astrabad (Gorgan); pastoral Turkmen tribes predominated north of this with seasonal movement occurring between environmental zones (Reid 1981 p.43). An account by a British traveller in 1723 indicates that raw silk, coffee, saffron, and cotton were key products of Astrabad (Teissier 2011 p.201). However, it seems that the end of the Safavids brought insecurity to the frontier regions, with the Turkmen tribes engaging in raiding settlements and caravans to capture slaves for work or sale in places like Khiva (Khazeni 2010 p.605). Because of these raids and general hostilities between the Turkmen and the Persians on the frontier, significant changes in land use and settlement occurred.

In the 18th century AD, a period of politically motivated European interest in the region that lasted until the early 20th century AD began, and resulted in the mapping of vast swathes of the larger region and numerous accounts of the resources, and routes of the plain (Baker 1876; Burnaby 1877; Burnes 1835; De Bode 1848; Fraser 1826; Marvin 1881; Muraviev 1871; Napier and Ahmad 1876; O'Donovan 1882; Vambery 1864; Yate 1900; also see Beard 1972; Teissier 2011 for more comprehensive lists and discussion). Equally, the mid-19th century AD saw several Persian expeditions into the steppes and deserts of Central Asia as part an agenda to catalogue, classify, and, in a way, to control, the wild frontier regions of Qajar Persia (Khazeni 2010).

The Persian villagers' fear of being captured and forced into slavery by the Turkmen tribes is a common thread in many accounts of the region in the 19th century AD (Baker 1876 p.51; De Bode 1848 p.68; Fraser 1826 p.256; Marvin 1881 p.177–252; Vambery 1864). In the Gorgan plain, rural villages were abandoned and people retreated to the safety of the forests and foothills of the Alborz; the Turkmen are blamed by both Persian and European authors as the cause of a decline in agriculture and commerce, a view linked with an imperial or colonial agenda (see Khazeni 2010 for a discussion of the biases in travel literature of the period). In most of the European accounts, writers emphasise how much more productive the Gorgan region would be if only a 'civilising influence' was present or the land was in the hands of better managers (read non-nomadic) (e.g. De Bode 1848 p.63; Fraser 1838 p.385; Marvin 1881 p.36; Yate 1900 p.233).

The core area of sedentary settlement and intensive agriculture (involving irrigation) appears to have retreated to the area immediately north of the Alborz, with raw silk, rice, cotton, wheat and citrus being key among its products (Baker 1876 p.51; Fraser 1838 p.380; Gilbar 1979 p.186–88; Marvin 1881 p.62; Napier and Ahmad 1876 p.113). However, the lands north of the forested zone, up to the banks of the Gorgan River were also being cultivated, though perhaps more extensively than intensively, by *chomur* or agricultural sections of both the Yomut and Goklan Turkmen (De Bode 1848 p.74; Muraviev 1871 p.11; Vambery 1864 p.95; Yate 1900 p.256–260). Several authors note that in addition to wheat and barley, the Turkmen tend plantations of mulberry trees for silk production (De Bode 1848 p.74–75; Napier and Ahmad 1876 p.131). With a few exceptions this zone appears to have been mainly dry farmed. Numerous European travel narratives mention traces of disused (or potentially ancient irrigation networks) north of the Alborz foothills zone and presented this as a contrast to the conditions contemporary to their visits. However, the yields of even dry farmed cultivation in the region between the foothills and the banks of the Gorgan River were considered good, though lessened as one moved north of the river (De Bode 1848 p.74).

The frontier between the Persian villages and the Turkman tribes is described in sweeping fashion by Marvin (1881 p.81): “A line drawn from Balkh to Astrabad on the Caspian….will separate the country of the Turcomans from that of the Afghans and Persians”. The edge of the densely cultivated area appears to sit somewhere not too far north of Astrabad, perhaps in the western half of the plain around the Karasu River (Khazeni 2010 p.604; O’Donovan 1882 p.162–163). Land use and agricultural intensity in this period seems to be defined by a cultural frontier between the Persians and the Turkman tribes, more than a clear divide between agricultural and pastoral economies.

In the interfluve between the Gorgan and Atrak Rivers, the *charwa* segments of the Yomut and Goklan Turkmen were primarily engaged in pastoralism, with small-scale cultivation taking on a secondary role due to both soil conditions and water resources (De Bode 1848 p.62–63; Marvin 1881 p.52–54; Muraviev 1871 p.20; Yate 1900 p.217). The Yomut Turkmen, for example, near Aq Qala had camels and sheep, of which the wool from the sheep was of fine quality and a key product for market (Khazeni 2010 p.605). Evidence for such seasonal land use north of the Gorgan River along the Caspian coastline has been located through remote sensing. Features interpreted as the remains of animals pens, and yurts have been recorded on the high resolution KH7 GAMBIT imagery, and likely date to seasonal use of this landscape within the last few hundred years (Hopper and Omrani Rekavandi in press).

However, while zones of dominant land use existed, these ‘boundaries’ were often crossed, at least seasonally, and the Persian villages, the *chomur*, and the *charwa* formed part of an integrated economy. Indeed, short and long range movement is an important part of the seasonal cycle in the 18th and 19th century AD for many communities living on the plain. The residents of Astrabad, if they were economically able, moved up into the cooler climes of the mountains in the summer (Fraser 1838 p.393). Some of the *charwa* segments of the Turkmen tribes would move to better watered areas, ranging between the banks of the Gorgan River and the edge of the forest zone in the hot dry summers when limited grazing was available in the plains, then retreat to the north again in the winter (Marvin 1881 p.33–35; Yate 1900 p.243). These movements vary for different segments of the Turkmen in different parts of the plain.

Equally, interdependence between these communities is evident in their reliance on each other for trade. The Yomut *chomur* lived only a few miles from the towns and villages of the Persians and were often engaged in trading, both agricultural and pastoral products within towns like Astrabad (Baker 1876 p.59; De Bode 1848 p.62). The Turkmen north of the Atrak were said to be dependent on people to the south for grain, as growing enough for their use was all but impossible except in years when rainfall was very high (Napier and Ahmad 1876 p.114).

This brief review of select historical descriptions of land use in the region, despite the obvious biases in these sources, provide us with important information on the relationship between geographical zones and land use potential, as well as how land use between the Islamic and modern periods may affect the survival and interpretation of even earlier landscapes. As in the 20th century AD, the most intensively cultivated and settled areas of the plain are south of the Gorgan River. Between the Early Islamic period and the 17th/18th century AD the area of intensive cultivation will have waxed and waned between the Alborz foothills and the Gorgan River, depending upon the political situation. Subsequent to the Safavid period, intensive agricultural practices appear to have been limited to the regions immediately north of the Alborz Mountains, and a mixture of extensive agriculture and grazing appears to have dominated between this foothill zone and the banks of the Gorgan River. As such, this pattern will have contributed to increased visibility of earlier landscapes to the north of the Gorgan River. It would also suggest, that the survival of landscape features would be higher immediately south of the Gorgan River than it would be immediately north of the Alborz foothills. This is evident in narratives from the 18th and 19th centuries AD where much older landscape features, were often noted upon north of the Alborz foothills zone, up to the Gorgan River; this included numerous tappehs, and irrigation systems, and of course the Gorgan Wall (De Bode 1848 p.63; O'Donovan 1882 p.207; Yate 1900 p.233, 248, 253).

5.2.3 ARCHAEOLOGICAL DATA

The high density of archaeological sites observed on the CORONA imagery and recovered by archaeological surveys would seem to suggest that, as in the Islamic through modern period, settlement was concentrated mainly in the southern part of the plain, with the density increasing nearer to the Alborz foothills. This density lessens somewhat north of the Gorgan River. Here more arid conditions prevail and less intensive historical and modern land use have created ideal conditions for the survival of archaeological sites; however, they are far less abundant in comparison to the southern part of the plain.

Besides more recent land use, other factors have also contributed to the pattern of settlement location visible in the archaeological record. Figure 5-5 illustrates the distribution of archaeological sites recorded by multiple surveys, and the coverage of each survey (see Table 3-5 for specific details on survey coverage). In several cases, the intensity of the survey, and/or the types of features that were (or were not recorded) is difficult to determine and this will undoubtedly affect any interpretations that are made based on the available data. Most of the surveys, however, have focused intensively on the plain to the south of the Gorgan River representing a clear bias in site recovery; equally, in almost all cases tappeh sites were more likely to be recorded than low level sites or artefact scatters due to their prominence in the landscape. As such, it is likely that low level sites (e.g. seasonal encampments or artefact scatters) are underrepresented in the survey record, and it is likely even more so in the southern part of the plain than the north (though this of course cannot be confirmed without intensive pedestrian survey). These types of sites have been recorded on survey by the *GWS* in small numbers, but are difficult to spot on the imagery for a number of reasons including the resolution of the imagery, and their lack of detectable signature. Exceptions exist, however, as shown by a number of ephemeral features that were located near the Caspian shoreline on a strip of GAMBIT imagery (Hopper and Omrani Rekavandi in press); in this case a combination of a well-preserved landscape, and very high resolution historical imagery created the perfect conditions for their identification (Fig. 5-6).

Based on the distribution of site types visible on the CORONA imagery, mounded sites are concentrated in the southern part (beginning to the north of the Elburz foothills) and gradually decrease in density as one moves toward, and especially north of the Gorgan River (Fig. 5-6). Equally, there are very limited examples of mounded sites within a few kilometres of the Caspian coastline, perhaps because of environmental conditions, but also because of the frequently changing coastline. On the other hand, possible camps and enclosures/animal pens appear to be more frequent in this sub-zone (Table 3-4, Fig. 3-14, and Fig. 5-6). This trend may be exaggerated by the fact that higher resolution imagery is available for the coastal zone (Chapter 3.1.3). However, analysis of the modern high-resolution imagery available on Google Earth that extends much further inland indicates that these features are concentrated in this area (Hopper & Omrani Rekavandi in press). If historical high-resolution imagery were available for other sub-zones of the plain, in particular the less agriculturally productive zones north of the Gorgan River, it is possible that similar features could be detected.

5.2.3.1 BROAD TRENDS IN SITE NUMBERS AND DISTRIBUTION

Trying to understand settlement distribution, and the area and density of occupation in different archaeological periods at individual sites based on the available data is problematic. As outlined in chapter 4, our current understanding of the long-term chronology of the plain is imperfect. As such it can be difficult to assign a site with confidence to particular archaeological periods. Furthermore, even the more well-defined periods are still of considerable length so that, along with other factors can result in the conflation of the number of sites assumed to be occupied at one time or mask short term rises and falls (see Hopper and Wilkinson 2013 p.39 for discussion of these issues). However, while the finer details may be obscured, several overarching trends can be identified.

During the *GWS* (2005-2009) we visited 53 sites both north and south of the Gorgan River (Fig 5-7). This is clearly only a small portion of the vast number of sites identified on the CORONA images or in other surveys. However, several broad trends were evident. One was that the landscapes to the north of the Gorgan Wall (and probably more relevantly, the Gorgan River) were dominated by sites likely dating to the Late Iron Age through to the Parthian periods; large canal systems in the west appeared to be linked to this pre-Gorgan Wall phase of settlement, and a great number of these sites in the east were linked by hollow way systems (Wilkinson et al. 2013 p.45–56) (Figs. 5-9 and 5-10). This significant increase in settlement and landscape investment to the north of the river suggested the possibility that an equivalent investment in the better-watered lands to the south may have also occurred; this implies that a considerable increase in population on the plain may have occurred between the Late Iron Age and the Parthian period. Because these sites to the north of the river were so easily identifiable on the CORONA imagery, and significantly fewer in number than those to the south, a considerable percentage were visited and assessed. This is in contrast to other surveys evaluated in this thesis; almost all concentrated on sites to the south of the river, or provided selective coverage of the northern areas (see Fig. 5-5). As such, the recovery of the archaeological settlement pattern to the north of the Gorgan River in the *GWS* is considered to be more complete than that to the south. That is, within these northern subzones of the plain, nearly all of the archaeological sites (predominantly mounded sites) visible on the CORONA imagery were visited providing more complete coverage for those particular geographical and environmental zones.

To the south of the Gorgan Wall, again, the survey focused on the sites in the vicinity of the wall, and on large (particularly rectilinear) sites that had been identified on the CORONA imagery (within 5 km of the wall or with specific geometric morphologies) or in the surveys of M.Y. Kiani, and attributed to the Parthian or Sasanian period. These investigations suggested that this zone had been densely occupied for a much longer period of time and contained many tappehs and mounded sites with occupation dating back to the Neolithic, Chalcolithic or Bronze Ages, and in some cases continuing through (with some gaps) to the Islamic period (Figs. 5-8 to 5-12). We also located numerous sites and landscape features dating to the Sasanian period (Fig. 5-11); although there appeared to be minimal evidence for Sasanian activity to the north of the wall (see chapter 7 for a full discussion). This suggested that, at least in the period contemporary with the wall, Sasanian activity was focused in the area south of the wall (Wilkinson et al. 2013 p.58–81). While some evidence of Islamic activity was noted on sites in the vicinity of the wall, or north of it, it appeared that the core area of settlement in this period was also likely to the south of the wall (Wilkinson et al. 2013 p.99) (Fig. 5-12).

A more in-depth analysis of specific chronological periods will be presented in chapters 6 and 7 that will incorporate the data on site size, morphology, and associated landscape features that can be derived from the analysis of the CORONA imagery described in chapter 3. To set the stage for this, I will now present a brief overview of the overarching long-term settlement trends. This is based on a comparison of the field survey results of the *GWS* (as presented in Wilkinson et al. 2013 and summarised above) with the trends that can be drawn out of a comparative analysis of the other field surveys that have been utilised as data sources for this thesis. As our knowledge of the chronology of settlement on the plain is imperfect, and each survey used different methodologies, the following overview will only be used to suggest broad trends and highlight periods where further research is needed.

The Abbasi (2011 Maps 5-7) (Figs. 1-31 to1-33) dataset suggests significant growth in the number of sites from the Neolithic through to the Early Bronze Age. However, the magnitude of this growth is uncertain as Neolithic and Chalcolithic sites are likely underrepresented. At multiperiod sites these phases are often buried under subsequent occupation layers as observed in the excavations at Tureng Tappeh (KH_123). At that site, the excavators found that these earliest occupation layers sat below the modern water table and could only be identified by pottery found in later period bricks (Deshayes 1967 p.123). Data from other surveys may also support an increase in site numbers between the Neolithic/Chalcolithic and Bronze Ages, even factoring in burial of the earliest levels, or the underrecognition of low level sites in the survey record. The Arne (1945 p.30) dataset indicates that black on red painted pottery (Chalcolithic Caspian Black on red ware comparable to Shah Tappeh III c. end of the 5th – first half of the 4th millennium BC) was found on 23 sites, while grey ornamented and burnished wares (likely representative of the Bronze Age, or possibly Iron Age) were found on 80 sites. The pottery descriptions in the Hiroshima University dataset (Shiomi 1976; 1978) are basic, making it difficult to assess periods of occupation other than at a broad level. However, painted pottery is listed as having been found at c. 50 sites, suggesting occupation prior to the mid to late 4th millennium when burnished grey wares appear to become dominant on the plain.

Burnished dark grey wares, likely representative of the Bronze Age, were found at around the same number of sites, however, a larger number, c. 96 sites, were reported to have grey wares (burnished and plain), but the lack of detailed descriptions and illustrations makes it impossible to say if this is grey ware of the Bronze Age, Iron Age, or even later. As such, from the admittedly limited data, it appears that site numbers do increase between the Neolithic and the Early Bronze Age. The suggested peak in the Early Bronze Age (Abbasi 2011 Map 7) appears to correlate to increased complexity identified in the material culture of sites in greater northeast Iran such as Tureng Tappeh (KH_123) and Tappeh Hissar (Thornton 2013b p.189–192). We lack data on site size by period making it difficult to comment on the size or morphology of the majority of sites attributed to the Bronze Age, and what this could imply about settlement density. A fuller analysis of this trend is an important topic for future research, but is beyond the scope of this thesis.

The evidence from the *GWS* suggested minimal occupation predating the Iron Age north of the Gorgan River; only a few sites with prehistoric pottery were located between the Gorgan River and the Gorgan Wall, and only one, GWS-14 (dated to the Bronze Age) appeared to sit north of the Gorgan Wall in the western steppe (Wilkinson et al. 2013 p.102–128). Equally, only one prehistoric site was indicated farther north than the location of the Gorgan Wall in the western steppe in the Abbasi (2011 Maps 5-9) maps; however, the coverage of that survey appears to be sparse in this subzone of the plain. The few sites indicated to the north of the Gorgan River in the prehistoric periods in the Abbasi (2011 Maps 5-9) maps are located in the eastern end of the plain. Here dry-farming is viable, and permanent streams running from the mountains and hills that jut into the plain from the east may be a significant factor in the northern limit of settlement in this period[15]. Sites with painted pottery (suggesting settlement in the Neolithic to likely no later than the Early Bronze Age) in other survey datasets (Arne 1945; Kiani 1982b; Shiomi 1976; 1978) also appear to be concentrated to the south of the Gorgan River. Overall, this suggests that settlement location was influenced by the availability of water resources (See Fig. 6-4).

[15] This is reflected in the following comment by Yate (Yate 1900 p.226) who says "The Sarisu stream is the limit of the water supply on the north, and except for a few springs, there was said to be no water all the way to the Atrak".

The decrease in the number of sites occupied from the Early to the Late Bronze Age, evident in the Abbasi (2011 Maps 7-9) maps is likely supported by the evidence from numerous excavations. Shah Tappeh (ARNE_142), Yarim Tappeh (KH_79), Narges Tappeh (HUS_19) and Tureng Tappeh (KH_123) were all abandoned between the second half of the 3rd millennium and the first half of the 2nd millennium BC (Abbasi 2011 p.4; Bovington et al. 1974 p.198; Cleuziou 1991; Crawford 1963 p.271, 273; Deshayes 1975 p.525–530; Orsaria 1995 p.488; Thornton 2013b p.195). However, without further intensive survey we have no data available on site size, and no way of knowing whether decreases in site number correlated to increases in site size. There is currently very little evidence for the transition from the Late Bronze Age to the Early Iron Age on the Gorgan Plain. It is therefore not surprising that no settlement has been confidently attributed to the Early Iron Age. As discussed in chapter 4, many theories have been put forward as to the nature of this supposed sedentary depopulation of the plain but it is only with further excavation, refinement of the ceramic chronology, and more intensive survey can we hope to understand the scale and duration of it. At present, little can be said other than our complete lack of knowledge about the Iron I and II periods is in stark contrast to the number of sites that appear in the subsequent Iron III and IV periods. No further analysis of settlement patterns prior to the Iron Age will be undertaken in this thesis. The above sketch is provided purely for context for later developments.

The significant number of sites that appear to be occupied between the Iron III and Parthian periods to the north of the Gorgan River in the *GWS* dataset suggests that there may have been a general increase in site numbers in the south of the plain as well. This appears to be the case in the Abbasi (2011 Map 10) dataset, which suggest that the entire plain was densely occupied in the late Iron Age. Information on site numbers derived from this source, however, may be misleading because of the lumping together of the Iron III and IV periods exaggerating the magnitude of the increase (Fig. 5-13). However, even if the number of sites was attenuated by distribution between these phases, there would still be a significant increase in site numbers (not just from the zero in the early Iron Age, but from the numbers given in the Late Bronze Age, compare 75 in the LBA to 332 in the Iron Age III/IV). The subsequent decrease in the number of sites identified as Achaemenid, followed by an increase in site numbers in the Parthian period should be treated with caution, however, because of the potential for significant overlap between the Iron III/IV period and the Achaemenid (and possibly the Early Parthian period) discussed in chapter 4 (Fig. 5-13).

As such, the smaller peaks and troughs indicated between the Iron III/IV sites and the Parthian period need further investigation to verify them.

The *GWP* clearly demonstrated that a significant amount of investment in large military sites and features related to defence occurred in the Sasanian period. This included the construction of the Gorgan Wall, numerous forts and campaign bases, and canal systems (e.g. Wilkinson et al. 2013 p.72–81). A massive urban site, Dasht Qal'eh (GWS_54), is also likely founded in this period. Little however, can be said about the rural landscape based on the *GWS* data. However, there appears to be an abandonment of many sites in the steppe (abrupt or gradual) prior to the building of the Gorgan Wall in the 5th or 6th century AD (Wilkinson et al. 2013 p.99). A considerable decrease in the number of sites between the Parthian and the Sasanian periods is evident in the Abbasi maps (from 223 to 72 sites) (Fig. 5-13). The majority of the Sasanian sites known in the *GWS* are located to the south of the wall, a trend generally mirrored in the Abbasi maps, with the exception of a few sites attributed to the dry farming region, north of the Gorgan River in the east. This will be discussed in detail in chapter 7.

The *GWS* noted that there appeared to be little use or reuse of sites in the vicinity of the wall or north of it in the Islamic period based on the sample of the sites surveyed. However, a few of the Iron III – Parthian sites in the dry farming zone north of the Gorgan River in the east had evidence for Islamic period reuse. The Abbasi (2011 Maps 13-14) dataset suggests a dramatic rise in site numbers in the Islamic period from the preceding Sasanian period, particularly in the southern half of the plain. Furthermore, Islamic sites noted to the north of the Gorgan River, appear to be concentrated in the eastern dry farming zone; this is also replicated in the Kiani (1982b) dataset. Given the apparent decrease in site numbers in the Sasanian period the magnitude of the rise in the Islamic period may be a real trend, but is likely also a factor of the confidence of the identification of Islamic pottery (mainly glazed wares) in this and all other surveys (for example in both Arne (1945), and Shiomi (1976; 1978) datasets the only confident period assessments made based on pottery are for the Islamic period), and the agglomeration of multiple phases of the Islamic era.

5.2.4 SUMMARY

The evidence suggests that the highest density of settlement has been concentrated to the south of the Gorgan River from the Neolithic through to modern times, and as such this landscape can be considered one of destruction in which only the most robust landscape features survive being erased by more recent settlement and land use practices. By contrast, the landscapes to the north of the Gorgan River have only seen sedentary settlement and agricultural investment episodically, and signature landscapes are comparatively well-preserved. Finally, along the Caspian coastline, the flat saline plains, inundated numerous times by high stands of the Caspian over thousands of years, has been a landscape of destruction, but currently exists as a landscape of survival in which traces of seasonal land use are still visible (Hopper and Omrani Rekavandi in press).

The following chapters will explore landscapes associated with these different environmental sub-zones of the plain. Chapter 6 investigates the patterns in the steppe margins north of the Gorgan River that appear to relate to Late Iron Age through to Parthian activity, while chapter 7 looks at the landscapes associated with the Sasanian period in the southern part of the Gorgan Plain. These case studies are used to discuss wider settlement patterns across the plain, and the specific social, cultural, economic and political adaptations that resulted in these signature landscapes (Wilkinson 2003 p.11, 214–15).

6 LANDSCAPES OF THE LATE IRON AGE THROUGH PARTHIAN PERIODS ON THE GORGAN PLAIN

This chapter looks at the evidence for investment in the landscapes to the north of the Gorgan River to provide a more chronologically and spatially nuanced understanding of settlement development within the relatively broad Late Iron Age through to Parthian horizon discussed briefly in chapter 5. This is accomplished through a more detailed investigation of the evidence generated through the *GWS* and excavations by the *GWP* at the site of Qelich Qoineq (GWS_16), the further remote sensing of satellite imagery, and the compilation of published survey and excavation data from the plain. I aim to shed light on the poor current understanding of settlement development in the Late Iron Age and the impact of territorial empires on this region in the 1st millennium BC. This will provide much needed context for an examination of Sasanian period settlement and land use patterns detailed in chapter 7.

6.1 CONTEXT FOR THE DEVELOPMENT OF IRON AGE SETTLEMENT SYSTEMS

Currently, there is little evidence for sedentary settlement on the Gorgan Plain in the Early Iron Age, and this may be related to changes in settlement locations, forms, or subsistence strategies (Cleuziou 1986; Mousavi 2008), though pinpointing the mechanisms for this change, or the precise form it took are currently beyond the available evidence. However, many scholars have noted a link between the grey wares of the Gorgan Bronze Age and ceramics of the Misrian plain in the Iron Age and by extension those of period IVA at Tureng Tappeh (Biscione 1977 p.122; Cleuziou 1986; Kohl 1984 p.208; Lecomte 2009 p.72; Mousavi 2008 p.111; Sarianidi 1971 p.309) suggesting that a complete break in socio-cultural traditions or the introduction of new populations are not adequate explanations for such changes. Equally, continuing explorations of early Iron Age settlement on the southern side of the Alborz may provide further information on related developments in these periods (Mousavi 2008; 2013; Sharifi and Motarjem 2014).

Until recently, the earliest published evidence for settlement involving substantial architectural features and at least semi-permanent settlement following the Late Bronze Age/Early Iron Age minimum on the Gorgan Plain to come from a stratified excavation was the re-occupation at the multi-period site of Tureng Tappeh (KH_123) located in the southern part of the plain. This occupation is suggested to date to sometime in the first half of the 1st millennium BC (Boucharlat and Lecomte 1987; Cleuziou 1985; Deshayes 1979). The assemblage of this phase (IVA in the Tureng Tappeh sequence) is clearly related to the so-called Iron Age Archaic Dehistan complex, which was identified in excavations by Soviet and French teams in the Misrian Plain and the Sumbar Valley in Turkmenistan (Chlopin 1973 Fig. 6; Kohl 1984 p.200–208; Lecomte 2005 Fig. 13; Muradova 1991 Figs. 28-32) (see Chapter 4.1.3). The Misrian Plain settlements appear to have been established earlier (c. 1500/1100 – 800/500 BC) than the comparable layers at Tureng Tappeh and represent the earliest known phase of settlement in that region. They are characterized as spatially discontinuous, or low-density settlements, and have been linked to the construction of large-scale irrigation systems that transformed the landscape from arid to arable (Lecomte 2009) (Fig. 6-1).

In 2008, excavations by the *GWP* took place at the site of Qelich Qoineq (GWS_16) located in the semi-arid western steppe to the north of the Gorgan River, and which radiocarbon dates suggest was occupied between the 8th and 5th centuries BC (Sauer et al. 2013 Table 14:1 and Fig. 14:10) (See Table 6-16 and Fig. 6-36). While this was not recognised in the original site report, the ceramics from Qelich Qoineq (GWS_16) (as discussed in detail in chapter 4) are clearly related to those of Tureng Tappeh IVA and those of the Archaic Dehistan complex in the Misrian Plain, a fact which allows us to place Qelich Qoineq (GWS_16) and its development within a wider regional social, political and cultural context.

A number of sites were also located to the north of the Gorgan River by the *GWS* that had site morphologies comparable with that of Qelich Qoineq (GWS_16) (Wilkinson et al. 2013 p.50, 57). Many of these sites also appeared to have been occupied in the Iron III, subsequent Iron IV (which includes the historical Achaemenid period, but is poorly defined) and/or Parthian period. It therefore seems that significant utilization of the more arid steppe environments to the north of the Gorgan River, on a scale not previously seen, began at least by sometime between the 8th and 5th centuries BC and potentially lasted as late as the 1st or 2nd century AD (Wilkinson et al. 2013 p.45). In the drier western steppe, this involved investment in canal irrigation, while to the east where rainfall is higher, a different strategy was employed. Here the lack of evidence for canal or other irrigation systems, along with the formation of hollow ways indicates that dry-farming was likely taking place, and that people and animals were moving beyond the boundaries of enclosed fields with frequency. This situation could be compared to the "marginal zone of rain-fed cultivation" in Northern Mesopotamia where hollow ways are a key feature (Wilkinson 2003: 42). The preservation of these sites and features on the CORONA imagery is very good, and seems to indicate that after their abandonment, and prior to the mid-20th century AD there was minimal agricultural investment in irrigation to the north of the Gorgan River (Okazaki 1968 p.18, Map 11, Table 1).

6.2 SETTLEMENT DISTRIBUTION AND ASSOCIATED LANDSCAPE FEATURES TO THE NORTH OF THE GORGAN RIVER

As discussed in chapter 5, several different sub-zones can be defined to the north of the Gorgan River in which settlement and land use appears to have been adapted to local environmental conditions (Fig. 6-2). These are:

- The western steppe
- The central steppe in the immediate vicinity of the Gorgan River
- The eastern dry-farming zone

Using the satellite imagery as a guide, the *GWS* visited 43 sites to the north of the river over the course of five field seasons (this excludes forts associated with the Gorgan Wall) (see Fig. 5-7). Thirty-seven of these were assigned *GWS* numbers and published in a survey gazetteer (Wilkinson et al. 2013 p.102–129). An additional six sites were visited in the field by Tony Wilkinson and Hamid Omrani Rekavandi, but no site numbers were assigned or ceramic samples retained. Table 6-1 lists all sites located to the north of the Gorgan River in the *GWS* (organised by sub-zone), their periods of occupation, and supplementary dating evidence from other sources (the reliability of the data from other sources has been evaluated in chapter 3 and 4). In the case of the *GWS* data, the laboratory assessments should be considered more reliable than the field assessments.

Of the sites listed in Table 6-1, this chapter will focus on those with dating evidence that suggests occupation between the Late Iron Age and Parthian periods, as well as sites with morphological characteristics and associated landscape features typical of the above. In addition, (while a much broader area composed of numerous different environmental and geographical subzones) the evidence from the *GWS* for Iron Age through Parthian settlement in the landscapes between the Alborz foothills and the southern banks of the modern Gorgan River will also be considered.

Therefore, Table 6-2 lists *GWS* sites from the different environmental subzones of the plain (both north and south of the river) with Iron Age III, IV, Achaemenid and Parthian occupation, and the certainty of these chronological designations along with some summary site counts by period (See Figs. 6-5, 6-11, 6-13, 6-14 and 6-25 for site locations). Table 6-3 presents an overview of the ceramic evidence for the dating of these same sites, while Table 6-4 provides information on their morphology (see Figs. 6-3, 6-6, 6-15, 6-16, 6-26, 6-30). Table 6-5 describes sites with morphological similarities to the sites listed in Table 6-4 (see Figs. 6-6, 6-15, 6-16, and 6-28), but which:

- were located on imagery and assigned a *GWS* number, but were not visited in the field, or;
- had no date assigned during the *GWS* either in the field or lab, or;
- had spot dates assigned in the field that indicated occupation in a later horizon.

Finally, table 6-6 lists and describes the morphology of sites surveyed by the *GWS* that had ceramics related to the Iron III assemblage represented by Qelich Qoineq, but that appeared to represent an earlier chronological horizon (see Appendices for images). Beyond this, no confident assessment of date could be made.

6.2.1 THE WESTERN STEPPE MARGINS

The *GWS* data suggests limited occupation of this zone prior to the Iron Age and those sites that exist appear to be small tappehs (e.g. GWS_10 and GWS_11, though an exception may be GWS-14) (Wilkinson et al. 2013 p.93) (see Fig. 5-6 and 5-8). As noted in chapter 3, the data from other published datasets, is of varying completeness and quality. For example, in the Shiomi (1976; 1978) and Arne (1945) surveys Islamic wares were the only ceramics identified by period (with the exception of the application of the generic “prehistoric” to some sites). While descriptions of the ceramics are sometimes given (i.e. red brown or grey pottery), they are not sufficient to determine periods of occupation without supplementary data. No sites, immediately north of the line of the Gorgan Wall in this sub-zone appear to have been visited by Abbasi (2011). The available information from other datasets therefore seems to indicate that sites dated to or with ceramics (e.g. ‘prehistoric’ or ‘painted pottery’) indicating occupation prior to the Iron III period mainly exist between the modern Gorgan River and the line of the Gorgan Wall in this sub-zone, but do not appear to extend much farther (Fig. 6-4). Furthermore, the sites in the western steppe appear to be in close proximity to palaeochannels. Issues in defining periods by these broad period or pottery descriptions are clear however, as the designation “Prehistoric” could also indicate non-painted wares of the Iron Age in the Kiani and Arne datasets, and sites with grey polished pottery in the Shiomi (1976, 1978) sample, while likely Bronze Age, could also be Iron Age. The examples for which site morphology is described or can be discerned from the CORONA imagery appear to be small or medium sized tappehs, though we cannot draw too many conclusions (see Table 6-7). Furthermore, intensive survey is needed as it is possible that pre-Iron III occupation in this zone also consisted of low-level sites not visible on the imagery.

However, in the Iron III period it appears that at least five large sites exist in this sub zone of the plain (Fig. 6-5). Qelich Qoineq (GWS_16), occupied solely in the Iron III period, covering an area of at least 80 ha (and possibly up to c. 87 ha), is characterized by a prominent central qal’eh, surrounded by a wide, flat, slightly depressed area (ranging between c. 80-130 m wide on the CORONA image) (Fig.6-3). Beyond this empty space are clear traces of discrete outer mounds, and the entire settlement is contained with ramparts. It is arguable, that this particular settlement morphology is a key component of a signature landscape (or landscapes) in the steppe margins.

Sites, surveyed by the *GWS* in the western steppe, with assemblages directly comparable to Qelich Qoineq (GWS_16) include GWS_3, GWS_5, GWS_15, and GWS_30 (Fig. 6-5). Of these sites, GWS_30 is the only one that appears to have been occupied solely in the Iron III period (Table 6-1 to 6-3). GWS_30 (c. 8-9 ha) is significantly smaller in size than Qelich Qoineq (GWS_16), but appears to also consist of a main qal’eh (c. < 0.5 ha in size) surrounded by an area, with a width of between 30 to 60 m, of empty space after which lower mounds are visible to the northeast, east and southeast (Fig. 6-6; Table 6-4). Unlike, Qelich Qoineq (GWS_16), however no outer ramparts were visible in the field or on the CORONA imagery.

The remaining three sites, GWS_3, GWS_5 and GWS_15, also had occupation that extended into the Iron IV period (Table 6-2, Fig. 6-5). GWS_15 (c. 85 ha) is similar in size to Qelich Qoineq (GWS_16), while GWS_3 (c. 18 ha) is significantly smaller, however both sites appear to have a prominent qal’eh surrounded by a depression followed by low mounding (Table 6-4; Fig. 6-6). GWS_5 is also characterized by a high qal’eh or mound, but no depression or area of empty space is visible around it. GWS_5 is also the only one out of the sites with Iron III occupation besides Qelich Qoineq (GWS_16) that may have been surrounded by a rampart (Table 6-4; Fig. 6-6). No evidence was recorded in the field, but a sinuous raised feature is visible on the CORONA imagery along the western extent of the site not unlike at Qelich Qoineq (GWS_16) (Fig. 6-6). However, as GWS_5 continued to be occupied into the Iron IV period it is impossible to state the age of the rampart.

Its location within this subzone and the marked similarity in site morphology to Qelich Qoineq (GWS_16) suggests that GWS_50 may also find its origins in the Late Iron Age, though no dating assessment was made by the *GWS* (Table 6-5; Fig. 6-5 to 6-6). The site was dated to the Prehistoric (indicating anything pre-Achaemenid/Parthian), Parthian and Sasanian periods by Kiani (1982b p.40). The Gorgan Wall has clearly cut the outer mounds of the site, and it appears to have been incorporated into the Sasanian defences (Wilkinson et al. 2013 p.124). Excavation was undertaken on the main qal'eh by our Iranian colleagues, and while a complete report is not yet available, ceramic types from the Late Iron Age through Sasanian period are said to be present, with thermoluminescence providing dates for several pottery types in the Seleucid and Early Parthian periods (Daghmehchi et al. 2016). If the distinctive morphology of the site took its form in the Later Iron Age (and possibly Iron III period based on its similarity to Qelich Qoineq (GWS_16)), this would mean that GWS_50 was likely as large, if not larger than Qelich Qoineq (GWS_16) in overall area. The field assessment indicated at least c. 73 ha, while the extent of the site as visible on the CORONA imagery may equate to up to 136 ha.

This distinct site morphology, epitomized by Qelich Qoineq (GWS_16), and GWS_15 and GWS_50 finds its closest parallels in the Misrian Plain of southwest Turkmenistan. Kohl (1984 p.200) reports that Soviet archaeologists recorded at least 20 Archaic Dehistan sites ranging in size from less than 1 ha to 224 ha. He describes them as follows: "they are not continuous tepes or mounds of cultural deposit, but areas of settlement centred around a fortified citadel which consist primarily of a series of detached mounds or "manors" stretched intermittently over a broad area". While, several of the Archaic Dehistan sites reached sizes considerably larger (at least three are between 120 and 220 ha (Lecomte 2009 p.72) than Qelich Qoineq (GWS_16), GWS_15 or GWS_50, this description seems remarkably similar to that of the Iron III sites mentioned above (see Fig. 6-7).

As suggested by the continuation of occupation at GWS_3, GWS_5 and GWS_15, the location of settlement in the western steppe appears to remain relatively stable into the Iron IV period, with the exception of Qelich Qoineq (GWS_16), and GWS_30, which appear to be abandoned. One other site of considerably size, GWS_4 (c. 38 ha), c. 18 km to the west northwest of Qelich Qoineq (GWS_16), appears to have its origins in the Iron IV period (Wilkinson et al. 2013 p.118) (Fig. 6-5). The site consists of a prominent qal'eh in the north central area of the site, around which is a clear depression, surrounded by lower mounding. A higher rectilinear qal'eh is located in the northeast corner and roughly rectilinear ramparts appear to enclose the entire site (see Fig. 6-6). It is possible that these ramparts were a later addition. The shape of the ramparts and the location of the site less than 2 km to the north of the wall led Sauer et al. (2013 p.363–364) to propose that the site may represent a Sasanian campaign base (see Chapter 7). If it dated to an earlier period, they suggested that it would be the only example of a large geometric/rectilinear site north of the wall. However, other sites occupied in the Iron IV period, such as GWS_25 in the eastern steppe (see below) have roughly geometric ramparts suggesting other examples may exist.

6.2.1.1 SHIFTING RIVER COURSES

The Gorgan River, as noted in chapter 5, has changed courses multiple times through complete or partial avulsions; the remote sensing of the imagery and field investigations have allowed for the description of four broad stages of its development (Wilkinson et al. 2013 p.30–32) (Table 6-8). These avulsions appear to have been more frequent in the western part of the plain than in the east and may be related to the shallower depth of the channels cutting through the western plain; avulsions are less likely to occur when channels are deeply incised for example in valleys (Jones and Schumm 2009 p.172–3). The Stage 3 channel, active at least by the Sasanian period and up until at least the Ilkhanid period, is the most easily traceable, and all or part of it may still have conducted part of the flow of the river toward Gomishan up to the 19th century AD. The dating and phasing of the Stage 2 channels was less certain, but two sub-stages were proposed and suggested to date sometime between the mid to late Holocene and the Parthian period. Stage 2a, being the northernmost, is visible to the north of the stage 3 channel, while Stage 2b is represented by traces of a meandering course of the river between the Stage 3 channel and the Stage 4 course of the modern river (Wilkinson et al. 2013 p.30) (See Fig. 6-8).

Most relevant to a discussion of the Iron Age landscapes of the plain, is the channel broadly classified as Stage 2b. This channel, likely composed of several sub-phases, is wider, but fainter than the stage 3 channel (Fig. 6-8 and 6-9). Evidence for at least partial avulsions can be found along the course with tributaries branching both north and south at various stages. While no clear associations can be made between archaeological sites surveyed by the *GWS*, and this palaeochannel, Table 6-9 lists sites identified in other surveys or on the CORONA imagery possibly associated with the Stage 2b channels, and available dating information. Little to no evidence for pre-Iron Age settlement is indicated, but a number of the sites (and in particular several sitting within relict meanders of the 2b channels – e.g. KH_174 and KH_175 – see Fig. 6-10) appear to have been occupied in the Iron Age III/IV, or Parthian periods (some also with later period occupation) (Abbasi 2011 Maps 10-12). This argument can be further strengthened by taking into account the morphological characteristics of these sites (Table 6-9). For example, both KH_174 and KH_175 consist of central qal'ehs or tappehs with surrounding low sprawling mounds.

Furthermore, by generating a list of sites with morphological characteristics noted on other Late Iron Age through Parthian sites (qal'ehs with outer mounds, complexes of low mounds, complex topographic mounds, depressions/ flat empty space) in this subzone, we can further test associations between morphology and dating (see Table 6-10). Defining clear site morphologies becomes more difficult as one approaches the modern Gorgan River, and so, this exercise was limited to the western steppe subzone (Fig. 6-10). Interestingly, the spatial distribution of these sites indicates that two are located along or within a very short distance of the Stage 2a or 2b channels. One sits within a relict meander of the Stage 3 channel, but may in fact, be an earlier feature cut by that channel. Another sits within a relict meander of the Gorgan River to the east of where the Stage 2 and 3 channels would diverge from the main branch making it difficult to make any direct associations. While the remaining two sites, are immediately north of the Stage 4 (modern) channel of the river, but also within a short distance of branching channels associated with Stage 2b. As such, the possibility of further sites relating to this horizon in this sub-zone are likely. These observations, of course, require ground-testing, but are nonetheless intriguing.

Traces of several possible irrigation canals are also located in association with the Stage 2b channel. For example, c. 7.5 km to the southwest of GWS-50 traces of what may be rectilinear field boundaries/canals appear to be cut by the Stage 3 palaeochannel, supporting a pre-Sasanian date. The most likely source of water for these canal-like features would be one of the iterations of the Stage 2b Gorgan River (Fig 6-9). Further to the west several canal-like features extend off of one of the Stage 2b River channels into an area of what appears to be archaic fields systems, and more specifically toward two archaeological sites that unfortunately have no dating information (KH_143 and KH_198) but again appear to consist of a higher mound surrounded by low mounds (Fig. 6-10 and Appendix B). It therefore can be posited that the 2b channels were active by the Late Iron Age at least and remained so until the bulk of the water shifted into the stage 3 palaeochannel sometime before or during the Sasanian period.

6.2.1.2 IRRIGATION SYSTEMS IN THE WESTERN STEPPE MARGINS

Two large canal systems were located in the western steppe (Fig. 6-11). These were labelled the North and South Canals and clearly predate the mid to late Sasanian period as evidenced by the fact that they are both cut by the Gorgan Wall; equally, the South Canal clearly cuts the North Canal suggesting that the latter was older than the former (Wilkinson et al. 2013 p.54). The main branches of these canals were followed on the ground by the *GWS* team in the 2007 season, and portions mapped on the CORONA imagery (see Wilkinson et al. 2013 p.51–57). Further mapping of these features on the imagery has extended our understanding of these systems and teased out details regarding their development through time.

Water supply for the North Canal appears to come from a relict palaeochannel of the Gorgan River, north of its current course in the vicinity of Fort 23 (FORT_27) (A on Fig. 6-11). In the field, the canal ran past GWS-5 (where the faint trace of a branch canal led south, possibly to the site), and was eventually lost only to reappear to the north of GWS-15 after which it runs for at least another 20 km before eventually disappearing west of Fort 30 (FORT_34) on the Gorgan Wall. Near its end, it is cut by the Gorgan Wall, and may either flow into the Stage 3 palaeochannel or have continued on for an unknown distance (traces of which were obliterated by the Stage 3 palaeochannel) (Wilkinson et al. 2013 p.51–54). Further inspection of the CORONA imagery shows that the canal can be mapped from north of GWS-5 toward the west for a further 4 km before it becomes difficult to trace amongst a series of palaeochannels (B on Fig. 6-11). At this point there are two possible trajectories for the canal that may represent different phases of use. The clearest, and likely most recent course, indicates that the North Canal continued (through the area of palaeochannels) for another 3 km in a roughly westerly direction before meeting another canal at a right angle (C on Fig. 6-11). The relationship between the eastern section of the North Canal (where it cuts through the palaeochannels) and a perpendicular canal, which will be labelled as the 'North-south branch of the North Canal' (as it runs on a roughly north-south axis) is not entirely clear. Despite these ambiguities, what is clear is that this canal (to the north of the undefined junction with the North Canal) runs for a further c. 1 km before turning west-northwest and continuing to the west (D on Fig. 6-11). It is the traces of this section of the canal that was followed in the field as the westerly extent of the North Canal. Further branches off this main line are visible heading into archaic field systems (to the west of D on Fig. 6-11). Prior to the configuration mentioned above, an earlier course of the North Canal may be represented by a faint dark line linking the visible trace of the North Canal just before the area of the palaeochannels, to the point where the North-south branch of the North Canal turns to the north northwest (E on Fig. 6-11). This suggests that the North-south branch of the North Canal may be one of a series of alterations that appear to have occurred during the life of the canal.

The southern extent of the North-south branch of the North Canal below the junction (C on Fig. 6-11) is cut after c. 5 km by the Gorgan Wall (F on Fig. 6-11). A few hundred metres after this, traces of the canal, perhaps following along beside a modern track, continue south for another 400m. At this point, the distinct signature of the canal is lost, but the alignment continues as a thick white line, perhaps representing a trace of the canal, or a modern track following its course. This anomaly extends south for another c. 1.7 km before turning to the southeast and running for another c. 1.5 kilometres after which it meets the South Canal (G on Fig. 6-11). The relationship between these two features it difficult to ascertain from the imagery, but it may suggest that portions of the North and South Canals may have been linked at some point.

Alternatively, these features may be entirely unrelated. Taking into account the topography based on the 90 m SRTM data, it appears that the North-south branch of the North Canal could have flowed toward the south. This would imply that the eastern section of the North Canal met the North-south branch of the North Canal at the junction (C on Fig. 6-11) described above, and water was channelled both north and then west along the western extension of the North Canal, and southward along the North-south branch. However, higher resolution topographic data is needed in order to evaluate the relationship between the North-south branch of the North Canal and the terrain. Ultimately, determining the relationship (and potential linkages) between these various canals will require further investigation in the field.

The North Canal likely supplied water to GWS_5, and it was suggested that it might have also supplied water to fields around GWS_15 and GWS_50 (Wilkinson et al. 2013 p.54, 113) (See Fig 6-11). As the canal clearly crosses through the grid of fields immediately to the north of GWS_15, a case can be made for contemporaneity between the canal and the site. GWS_5 and GWS_15 were both occupied in the Iron III and IV periods, limiting our ability to refine the dating of the North Canal. No clear link can be made between the North Canal and the dense network of field grids visible in the immediate vicinity of Qelich Qoineq (GWS_16). However, several palaeochannels (that run east-west) and other faint linear features running parallel or perpendicular to the North Canal, are found to the north of Qelich Qoineq (GWS_16) (M on Fig. 6-11). One in particular, while appearing channel- like at its eastern extent can be traced to the south of GWS_15, where it appears to cut a hollow way extending from the site, and becomes distinctly canal-like in appearance with light coloured upcast banks. While difficult to discern, it may have been cut by the South Canal, and headed toward the site of Qizlar Qal'eh (GWS_50). Furthermore, dark linear features extending from the north and south side of Qelich Qoineq (GWS_16) may represent canal features or, hollow ways. While it cannot be confirmed without further on the ground investigations, it is possible that the North Canal via branch canals, an earlier iteration of this canal, or another small-scale irrigation system supplied water to Qelich Qoineq.

The other large canal in this region, the South Canal, as observed by Wilkinson et al. (2013 p.54), takes its water from the Gorgan River somewhere to the south of Fort 23 (FORT_27). It is visible on the imagery (and for the most part in the field) heading in a roughly westerly direction for at least 40 km. It is cut by the Gorgan Wall north of the site of Qal'eh Kharabeh (GWS-1) (H on Fig. 6-11) after which it heads roughly northwest and cuts the North Canal (I on Fig 6-11), ending near Fort 32 (FORT_36). At this point the line of the Gorgan Wall follows along the same trajectory as the canal, and the wall may have obliterated further traces of it (J on Fig. 6-11).

Because it appears to be later in date than the North Canal, it has been speculated that the main purpose of the South Canal may have been to supply water to the site of GWS_4 (Tokhmoq Tappeh), which was occupied at least by the Iron IV period (Table 6-2 - 6-3). However, further canal-like features are found in the vicinity of the site that complicate this interpretation such as, a canal feature that appears to run from the Stage 3 Gorgan River toward the site (though no direct association can be made) (Wilkinson et al. 2013 p.54) (K on Fig. 6-11). Closer inspection of the imagery offers the prospect that this canal-like feature may also have been associated with the Stage 2b Gorgan River, and was subsequently cut by the Stage 3 River, and later possible irrigation features (L on Fig. 6-11). As such, associating water supply with GWS_4 based on any other evidence besides proximity is difficult. However, around 3 km to the north east of GWS_4 grid-like linear features may represent a branch of the South Canal irrigating relict fields that may or may not have been associated with GWS_4.

The South Canal also borders the southern side of GWS-3, occupied in both the Iron III and IV period (Table 6-2). It is difficult to establish the exact chronological relationship between the site and the canal. The canal could be earlier than the site (or at least the outer mounds of the site at their greatest extent), contemporary with it, or perhaps even later than it. In the last case, building the canal around the site would have been preferable to negotiating the topography of the outer mounds.

The relationship between the eastern and western sections of the North Canal are clearly more complicated than originally thought, as is the relationship between the North and the South Canal. A complex palimpsest of features suggests the following stages of development in irrigation systems in this part of the plain.

- The North Canal, the earlier of the two large canals, may have had several phases and courses. It is possible that the original course of the North Canal is represented by the westward trajectory of the two clearest sections of the canal on the imagery (i.e. A to B, and then D to its terminal near Fort 30 (FORT_34) on the Gorgan Wall on Fig. 6-11). Alternatively, at the point where the North Canal becomes difficult to trace (near B on Fig. 6-11), it may have continued west as represented by the traces of possible canal features running to the north of Qelich Qoineq (GWS_16) and south of GWS_15 (M on Fig. 6-11). The North-south branch of the North Canal (D to F on Fig. 6-11) that clearly links to the western portion of the North Canal (D to its western terminal on Fig. 6-11) may be contemporary, or a later alteration. The North-south branch of the North Canal may have an undefined relationship with the South Canal as well.
- If the eastern section of the North Canal (A to B on Fig. 6-11) flowed into the North-south oriented canal (D to F on Fig. 6-11) at some point, then the 90m SRTM DEM

data would suggest that the North-south oriented canal would have flowed south (Fig. 6-12). However, given the resolution of the topographic data, it is too coarse to allow us to trace the exact line of the canal, and determine if and how it may have negotiated any topographic obstacles.

- As mentioned above, the North Canal appears to have taken its water from a palaeochannel of the Gorgan River north of its current course in the vicinity of Fort 23 (FORT_27). If an avulsion shifted the bulk of the water flow to the south, then this could have left the North Canal dry. If the North Canal were left dry at some point, it would have no longer been the main source water for GWS_5. The ceramics from the site indicate occupation in the Iron III and IV period, including possibly the Achaemenid or even Parthian phases, which could suggest that the canal would have run dry rather late in the Iron IV/Parthian sequence. Alternatively, a different source of water was used (the South Canal?), or communities at the site no longer relied on irrigation agriculture to the same extent.
- If a gradual or abrupt avulsion reduced or ended the flow of water along the North Canal, this may have resulted in the construction of the South Canal. Other socio-political factors may also have been at play in the choice to abandon the North Canal in favour of the South.
- However, the fact that the South Canal appears to cut the North Canal just northwest of GWS_50 suggests that at some point the North Canal was no longer in use while the South Canal was still active. The location of GWS_15 along the North Canal, and its occupation into the Iron IV period may suggest that the North Canal was active contemporary with the Iron IV period. However, this site may also have been supplied by the South Canal. How much earlier the North Canal was constructed (contemporary with Qelich Qoineq (GWS_16) ?) or how much later it fell out of use in favour of the South Canal is difficult to say. However, by the Sasanian period, the North Canal, and the South Canal, to the north of the wall, appear to have been out of use. Parts of the South Canal, south of the Gorgan Wall, however, may have remained in use or been rejuvenated in the Sasanian period (Wilkinson et al. 2013 p.80) and may be associated with further canal features running parallel to the Gorgan Wall (N on Fig. 6-11). This will be discussed in more

detail in relation to Sasanian and Islamic period water features in the following chapter.

As such, the relict field systems located to the north of the stage 3 palaeochannel and the Gorgan Wall are possibly related to the use of the North and South Canals. It is difficult to separate these features chronologically or make associations between field systems and specific archaeological sites in all but a few cases (i.e. GWS_15 and Qelich Qoineq (GWS_16)). Environmental conditions and subsequent alterations to the landscape have affected the visibility of these features. For example:

- The observable pattern of field systems is linked to the salinity of the soil (see Wilkinson et al. 2013 p.57). Therefore, as soil salinity decreases to the south, and to the east (as indicated on the 'Regional Map of Land Resources and Potentialities: Gorgan Region – East Mazandaran 1968') our ability to see these features also decreases.
- The southern limit of the visible area of relict field systems sits just north of the Stage 3 palaeochannel. Newer courses of the Gorgan River (Stage 3 and 4), the deposition of alluvial soils along their courses, and more modern field systems may have obscured earlier features. In general, where modern field systems (visible as much larger rectangular plots of land) are apparent, the visibility of the archaic field systems decreases.

Thus, while the visible extent of these features covers an area of approximately 18000 ha, this cannot be used to indicate the total area under cultivation at any one period in time with confidence. Determining sustaining areas, and by extension population estimates, for particular sites in the western steppe based on the extent of field systems in their vicinity is also complicated for the reasons given above, and the multi-period nature of many sites. While, for example, Qelich Qoineq (GWS_16) appears to be a single period site, the clear truncation of its associated field systems by modern agriculture illustrates this difficulty.

Furthermore, we must also consider that possibility that some of these field systems (and by association the settlements they are associated with), predate the construction of the canals (or earlier irrigation systems). While the western steppe is drier than the eastern steppe margins, is possible that dry-farming could have been practiced. Equally, the (albeit rather minimal) evidence for hollow ways in the vicinity of sites such as GWS_15 and Qelich Qoineq (GWS_16) is intriguing (Chapter 6.4.2.1 and Fig. 6.37 and 6-38). While hollow ways are not found exclusively in dry-farmed landscapes (see Casana 2013), their presence could indicate a land use strategy less dependent on irrigation.

6.2.2 THE CENTRAL STEPPE MARGINS AND SITES IN THE VICINITY OF THE GORGAN RIVER

GWS-6, GWS_7 and GWS_8 were located and surveyed by the *GWS* in the central steppe margins. GWS_6 and GWS_8 had material that shared similarities to the assemblage at Qelich Qoineq (GWS_16), but may represent a slightly earlier horizon (see Table 6-1 - 6-3). GWS_6 equates to Kiani's (1982b Fig. 15.3) Qizil Qal'eh, which he dates to the Prehistoric, Parthian and Sasanian periods, though the not-particularly diagnostic "grey pottery of the Parthian period" that he illustrates from the site does little to clarify the dating any further (Kiani 1982b Fig. 54); however, no Parthian or Sasanian wares were noted in the *GWS* assessments. The dating of GWS_7 is even more ambiguous, and was suggested to represent an earlier Iron Age or an Early Sasanian horizon (Wilkinson et al. 2013 p.114) (see Table 6-3), and may just as well illustrate the difficulty in defining certain ceramic types because of long-lived traditions. Besides the Gorgan Wall and its associated forts, other sites located on the CORONA imagery and in several cases mapped by M.Y. Kiani's (1982b) aerial photographs are also visible in this sub-zone, though dating evidence is almost non-existent, barring two sites identified with Islamic material (Table 6-11 and Fig. 6-13).

No clear evidence for pre-modern irrigation has been found in the central plain to the north of the Gorgan River. Numerous palaeochannels, which appear to have drained into the large depression that exists between the Gorgan and Atrak Rivers, are visible in this area. These may represent parts of a much earlier phase or phases of the river (broadly called stage 1). The antiquity of at least some of these features is attested by the fact they are cut by the wall, and in one instance, a Sasanian period canal is built into the dry bed of one of these channels (Wilkinson et al. 2013 p.79). The palaeochannels appear to have flowed from the vicinity of the Gorgan River, as well as from the hills that intrude into the plain from the northeast. The visible limit of these features is obscured by a group of freshwater lakes, Alagol being the largest, and associated wetlands whose water levels vary dramatically by season (Patimar 2008 p.911–912). Small irrigation channels, taking water from the river toward the north, and in use since at least the 1960s, appear between modern field boundaries visible on the CORONA image.

Due to modern land use regimes, disturbance to past landscapes is much higher here than it is in any other portion of the plain to the north of the Gorgan River; more so, for example, than in the western steppe. Even so, all of the sites mentioned above are located within the modern irrigation zone, which is within 10 km of the modern Gorgan River. The extent of the irrigation network is clearly visible on Fig. 6-13. The background image for this map is a Colour Infrared (CIR) Landsat 7 image in which healthy vegetation appears in bright red, and in this case highlights the field systems. The lack of archaeological sites further north than the currently irrigated areas appears to correlate with the limits of the lakes and marshlands.

The minimal distance between the Gorgan and Atrak Rivers in this vicinity, along with the proximity of these lakes to the Gorgan River has provided this subzone with considerable water resources despite being at least 15 km farther north than the stage 2b palaeochannel in the western steppe. The mid extent of the Gorgan River receives c. 300mm of rain per annum supporting naturally steppic vegetation; however, in recent times, as well as being utilized for grazing, its alluvial soils were irrigated via river waters to grow wheat and cotton (Van de Weg et al. 1968). This is evident on the CORONA image and on the colour infrared Landsat image from 2000/2001 that demonstrates a dense pattern of irrigated fields from the vicinity of the origin of the North Canal to where the river again dips towards Gonbad-e Kavus, a straight-line distance of approximately 30 km (Fig. 6-13). Therefore, it is possible that if fields, contemporary to the sites mentioned above were being irrigated, it would not have required the construction of large-scale irrigation systems like in the western steppe, but could have been accomplished using smaller channels taking water directly from the river toward the north. If this were the case, then tracing these channels would be difficult in the modern landscape.

6.2.3 THE EASTERN DRY-FARMING ZONE – SETTLEMENTS AND HOLLOW WAYS

North of the Gorgan River, but to the east of the modern city of Gonbad-e Kabus, another sub-zone of the plain can be defined (Fig. 6-2). Sites in this zone surveyed and assessed by the *GWS* are presented in Table 6-1, along with supplementary dating evidence from other surveys. No evidence for canal or other irrigation systems appears to be present, but well-preserved hollow way systems are abundant. This suggests dry-farming was practiced. All of the sites in the eastern plain to the north of the Gorgan River surveyed by the *GWS*, bar one (GWS-40), have associated hollow way features. Two groupings of sites can be found within the sub-zone; group one is to the north and east of Gonbad-e Kabus up to a right-bank tributary of the Gorgan River called the Kal Aji, and group two is between the Kal Aji and the Sari Su River (Wilkinson et al. 2013 p.47–48).

The widths of the hollow ways were difficult to measure accurately on the imagery because the edges of these tracks are often diffuse (Ur 2010 p.77 notes a similar problem in Northern Mesopotamia), but ranged between c. 10 m up to 65 m with the majority appearing to be c. 20m in width (Fig. 6-24 and 6-27). The Gorgan hollow ways appear to be narrower than examples from Northern Mesopotamia (Ur 2010 p.84, Fig. 5.26). This may be the result of a combination of the amount of time they were in use, how they were used, or the local environment. This will be discussed in more detail in the following sections.

6.2.3.1 SITES WITH HOLLOW WAYS - GROUP ONE

GWS_18, GWS_19, GWS_20, GWS_21, GWS_22, GWS_23, GWS_24, GWS_38, GWS_43, and GWS_44 all have radial hollow ways extending out from them, or leading toward them (Fig. 6-14). GWS-18 (c. 15 ha), GWS-19 (at least 23 ha, but up to c. 57 ha) GWS-22 (c. 10 ha), and GWS_24 (c. 7-8 ha?) all consist of prominent qal'ehs or tappehs (c. 0.5 ha or less) with low outer mounding in the immediate vicinity (Fig. 6-15). GWS_43 (c. 12 ha?) is a grouping of low mounds (Fig. 6-15). Several sites, besides having distinctive qal'ehs and outer mounding, also had traces of ramparts, observed in the field or on the CORONA imagery. These are GWS-20 (at least 12 ha, but up to 45 ha), and GWS-21 (c. 72 ha), and GWS-23 (c. 7-9 ha), GWS_38 (at least 8.5 ha, but up to c. 19 ha), and GWS_44 (c.13 ha, but up to c. 30 ha) (Fig. 6-16).

To the southeast of GWS-23 and to the southwest of GWS-24 several hollow ways were located that appeared to radiate out from a central point. Close inspection of the imagery revealed faint traces of a mound or mounds indicating a site (KH_17) (Fig. 6-17). This was supported by the maps of Kiani (1982b Map 2) that also indicated a possible mounded site in this location, though no details, or dating information was provided. One further location upon which hollow ways converge was located, but no site features could be clearly distinguished at their centre; it is possible that this location represents another site that has been ploughed out or otherwise destroyed (see Fig 6-14).

While the certainty of the dating information is variable from site to site, Iron IV occupation can be confirmed on at least five sites (GWS_18, GWS_20, GWS_21, GWS_22, and GWS_23) surveyed by the *GWS* that have associated hollow ways (Table 6-12). The elements of these assemblages do not allow us to make much of a chronological differentiation between sites assigned to the long Iron IV period, however, GWS_21 and GWS_23 both had distinct carinated jars with "S" profile rims possibly associated with the Achaemenid period (Table 6-3); how meaningful this is, however, is open to debate and will require further refinement of the chronology. Evidence from other surveys suggests the possibility of similar dating for those sites not confidently dated by the *GWS* (Table 6-12). Evidence for occupation earlier than the Late Iron Age on any of the sites with radial hollow ways in any of the surveys or site visits is limited[16]. The exceptions being GWS_18, which may have an EBA component (Abbasi 2011 Map 7), and GWS_24, which appeared to have some affinities with the Qelich Qoineq (GWS_16) assemblage, but was suggested to be somewhat earlier in date (though this site is indicated as having been occupied in the Iron Age III/IV and Achaemenid periods in other datasets – see Table 6-12). Excluding the sites discussed above, other evidence for pre-Iron Age activity is indicated by Abbasi (2011 Map 5-9). However, these and several sites that he attributes to later periods also not discussed above, are not visible on the CORONA imagery, nor are any hollow way features obvious in their vicinities; this may support the idea that pre-Late Iron Age occupation of this zone consisted of small low tappeh sites (see Table 6-13). The *GWS* field assessments also identified common Middle Islamic pottery at GWS_19 and GWS_20, which seemed to square with other assessments (Table 6-12). The suggestion of Sasanian wares at GWS_19, GWS_20 and GWS_23 in the *GWS* field assessments was not echoed in the *GWS* laboratory assessments. Continued occupation into the Sasanian or Islamic period was also suggested at GWS_22 (Abbasi 2011 Map 13-14) though no evidence was found for this in the *GWS* field or laboratory assessment (Table 6-12).

A more in depth examination of these hollow ways, their characteristics and phasing can help us to understand land use in this subzone in different periods and perhaps to explore possible connectivity between sites. Several sites including GWS_18, GWS_23, GWS_24, GWS_38 and KH_17 had hollow ways that could not be connected with any other site with

[16] GWS_21, GWS_22 and GWS_38 are indicated in Kiani (1982b) as having 'prehistoric' pottery. However, this could indicate anything earlier than the types that he designates as Achaemenid or Parthian, including pottery of the Iron Age.

confidence, and there was little evidence of phasing (e.g. one hollow way cutting another), other than at GWS_18. Here, the longest of the radial hollow ways at this site (HW_10 which is c. 1.4 km in length and over twice as long as any of the others) is the most likely candidate for an inter-site route way. It crosses (is possibly cut by?) one of the hollow ways (HW_11) that appears to be radiating out from GWS_19 suggesting different dates for the use of these features (Fig. 6-18). The rest of the hollow ways at GWS_18 appear to narrow toward their extremities and fade out suggesting that they functioned to move people and animals beyond fields surrounding the site as suggested for similar features in Northern Mesopotamia (Ur 2003 p.110–111). This is also apparent at KH_17 and in some of the westerly hollow ways at GWS_23.

GWS_19, GWS_44 and GWS_20 have clear evidence for different phases of route systems associated with them. Several dark broad hollow ways, similar to those at GWS_18, are visible extending from the eastern side of GWS_19 (Fig. 6-19). These are somewhat different in morphology to several slightly narrower hollow way features, often with lighter edges, extending out to the south, and east of the site, where one of the latter cuts one of the former. However, it is not possible to assign all hollow ways at this site to one phase or another, and some may have been used or reused for considerable periods of time. GWS_19 appears to be connected to GWS_44 by one of the slightly narrower, lighter edged hollow ways (HW_18) (Fig. 6-20). Phases of activity around GWS_44 are also visible (Fig. 6-21). Several of the hollow ways radiating out from the eastern side of the site (HW_62, HW_63, HW_64 and HW_65) appear to cut a hollow way (HW_71) running southwest-northeast past the site from an area c. 700m to its south. Along with three other hollow ways (HW_61, HW_163, HW_165), HW_71 may form a radial pattern around a no longer extant site or landscape feature, though this can only be speculated on.

GWS_20 also features hollow ways of apparently different morphologies. Several broad, dark hollow ways radiate out from the site, along with several narrower dark linear features with lighter edges (Fig. 6-22A). A clear example of phasing is also found here, where one of the former (HW_27) is cut by two of the latter (HW_134 and HW_141) perhaps again indicating use in different periods (Fig. 6-22B). Some of the narrower features with lighter edges (e.g. HW_135) also cut broad radial hollow ways) extending from GWS-21 (Fig. 6-23A). Furthermore, one of the hollow ways extending from GWS-20 appears to meet/cut through the outer rampart of GWS_21. The hollow ways radiating out from GWS_21 are similar in appearance to the earlier phase of hollow ways at GWS_20 and GWS_19. GWS_21 appears to be connected to GWS_22 via one of these hollow ways (Fig. 6-23B).

As such, GWS_19, GWS_20 and GWS_44 have hollow ways that suggest they were connected at some point. GWS_21 and GWS_22 also appear to have been connected at some point. At least one of the phases of route ways associated with GWS_19 also appears to predate that of GWS_18. If we now consider this evidence in light of the dating information reviewed above, several suggestions can be made.

GWS_19 and GWS_20 were occupied in the Iron IV (and possibly Parthian or Sasanian though the late may be less likely[17]) periods, as well as the Middle Islamic period (Table 6-12). GWS_21, also occupied in the Iron IV (and possibly Parthian period), was not noted as Middle Islamic in the *GWS*. However, Kiani (1982b p.60) indicates Middle Islamic occupation, particularly Seljuk (1037-1194) remains recorded during excavations at GWS_21 (which were not subsequently published); his map also appears to indicate that GWS_20 and GWS_21 were considered closely connected and possibly parts of one larger site complex in the Middle Islamic period (Kiani 1982b Map 2). There may also have been contemporary occupation on parts of GWS_21 and GWS_22. No Islamic wares were noted on GWS_22 (it was assessed as mainly Iron IV) in the *GWS* laboratory assessments, but it is suggested to have material from the Iron Age through to the Islamic period in other datasets) (See Table 6-12). However, some of the narrower, lighter edged hollow ways extending from GWS_20 cut those of GWS_21, in particular those of the same morphology that connect GWS_21 to GWS_22. This suggests that some of the hollow ways associated with these two sites were earlier in date than the later phase of GWS_20 hollow ways.

Statistics on the hollow ways including length, width and the size of the sites they are associated with also provide useful information. If we plot the length and width of hollow ways around each site, those with no occupation later than the Iron IV through Parthian periods and with no clear connections via hollow ways to other sites (GWS_18, GWS_24), are generally shorter and broader (Fig. 6-24). Those sites with occupation in the Late Iron Age/Parthian periods, and either definitely or likely including Islamic period occupation (GWS_19, GWS_21, and GWS_44) had a wider range of hollow way types including some

[17] The *GWS* laboratory assessment did not indicate any diagnostic Sasanian wares.

that were considerably longer. As comparison, in the Khabur Basin in Northern Mesopotamia wide radial routes are associated with Bronze Age sites and longer narrow routes were often associated with Hellenistic or later sites (Casana 2013 Fig. 11; Wilkinson 1993 p.558; Wilkinson et al. 2010 Fig. 2; Ur 2003 p.107). Furthermore, the later period hollow ways, while serving numerous functions, are more likely to connect sites than their earlier counterparts (Casana 2013 p.12).

If we take site size into consideration, other observations can be made. Site size here is considered to be the maximum extent of the site as determined by the *GWS* or through inspection of the CORONA imagery. While the data does not exist with which to assign site size by phase, these metrics still provide some useful comparative information (Table 6-14). Sites for which the visible maximum extent on the CORONA imagery was between 0 and 20 ha, the maximum length of hollow ways did not exceed 2 km, and for all but GWS_24, the average length of hollow ways was between 0.5 – 0.7 km. For the four sites that appear to exceed 20 ha in size, the average length of hollow ways was over 1 km and the maximum length ranged from 2.4 km to 5 km. Of the largest sites, and those with the longest hollow ways, GWS_19, GWS_20, GWS_21 and GWS_44, all appear to have been occupied in the Islamic, and more probably Middle Islamic period, and have clear phasing of hollow ways surrounding them. Furthermore, networks (indicated by the number of hollow ways) are denser at sites with two or more substantial occupation events.

As such, the dating evidence combined with the evidence for hollow way phasing is suggestive of several phases of hollow way formation and use in this landscape, likely associated with a possibly lengthy period between the later Iron Age and the Parthian period, and perhaps another phase in the (Middle) Islamic period.

6.2.3.2 SITES WITH HOLLOW WAYS - GROUP TWO

The sites discussed here are distinguished from those clearly associated with the Gorgan Wall (forts) or those on the immediate banks of the Gorgan River (Fig. 6-25). These include GWS_25, GWS_26, GWS_27, GWS_40, GWS_41 and GWS_42; all had hollow ways except GWS_40. In the *GWS* laboratory assessments GWS_25, GWS_26, GWS_27, and GWS_42 all appeared to be occupied in the Iron Age (mainly the Iron III or IV period, with the possibility of a slightly earlier Iron Age horizon at GWS_27). The field assessments, in some cases, suggested possible later occupation (though not corroborated by the laboratory assessments at any of the sites except for possibly GWS_25). However, occupation after the Parthian period was not reflected in other datasets for these sites or for GWS_41 (see Table 6-15).

In referring to the mounds in this grouping, Thompson (1938 p.197), who visited and conducted a brief geological survey of the plain in the early 20th century AD observed that these sites consisted of "hollow squares roughly 325 feet (c. 100m) on the side. Each is surrounded by a ditch, which, as in the case of the Qizil Alan, evidently furnished the earth for the walls as well as serving as the moat". GWS_26 and GWS_27 were occupied in the Iron III period and GWS_26 continued to be occupied in the Iron IV period, while GWS_27 had ceramic elements suggesting an unidentified earlier or later occupation (Table 6-3). GWS_26 consists of an upper and lower qal'eh with outer mounding (Fig. 6-26B). GWS_27 is far less clearly delineated on the imagery than the other Iron III sites, and it was observed in the field that the mounding around the site was not particularly distinct or widespread (Wilkinson et al. 2013 p.120). GWS_25, and GWS_41, occupied in the Iron IV period, also appear to consist of qal'ehs surrounded by low outer mounding, though no uniform layout within the general morphology in notable (Fig. 6-26A and 6-26E). GWS-25 (c. 27 ha) the only site with visible ramparts in this group, may also be later in date within the Iron IV sequence than the other sites in this area, as it shares no affinities (even residual) with Qelich Qoineq (GWS_16) (Fig. 6-26A). It may have remained occupied into the early Sasanian period (Wilkinson et al. 2013 p.119) (see chapter 7 for discussion). GWS-42, is an anomaly to the qal'eh with outer mounds pattern, in that it appears to consist of only a small tappeh (Fig. 6-26F). Outer mounding seems unlikely due to the hollow ways that appear to extend from near the base of the mound. However, dating evidence suggests occupation in the Late Iron Age to Parthian horizon (Table 6-15).

GWS_40 (the only *GWS* site without hollow ways in this group) was not dated by the *GWS*, but Gorgan Wall bricks found on the surface (though acknowledged to not necessarily be associated with occupation at the site) and its morphology led to the suggestion that it might represent a Sasanian period fortlet to the north of the wall (Sauer et al. 2013 p.306) (Fig. 6-26D). Interestingly, Abbasi (2011 Map 7) suggests the site is Early Bronze Age. Either way, the dating of the site to an earlier or later phase seems to square with its lack of hollow ways.

Sites recorded by other surveys are also located in this zone. Three other sites (NTS_13, NTS_206 and NTS_322), apparently occupied in the Late Iron Age or Achaemenid period are situated c. 3-6 km further to the east than this grouping (see Fig. 6-25); only one (NTS_322) is distinguishable on the CORONA imagery, or on the imagery available on Google Earth, as a small mound or qal'eh. Little more can be said, and no hollow ways are visible in association with the locations of these sites. Several anomalies were also indicated on Kiani's (1982b Map 1) map of the wall corridor in this zone (KIA_39 to KIA_43 on Fig. 6-25); however, inspection of the CORONA imagery was not able to confirm the presence of such features and their archaeological significance has been rated as low. Further sites, recorded by Abbasi (2011 Maps 5-9) are found along the course of the Sari Su River, and are indicated to have been occupied between the Neolithic and Bronze Ages (NTS_6, NTS_270 and NTS_315). Pedestrian survey is needed to confirm this pattern, but it seems plausible that prehistoric sites may have been more abundant in the river valleys as opposed to the drier steppe zone.

The dating of the hollow way systems to a primarily Iron Age – Parthian horizon in this zone is reinforced by the fact that the hollow ways radiating out from GWS_25 and possibly GWS_26 are cut by the Gorgan Wall. Hollow ways in this area are on average between c. 15 and 30 m wide, and all but one, are less than 2 km in length (Fig. 6-27). Evidence for phasing as seen in the first group discussed above, is not apparent, and the hollow ways are generally dark in appearance, though narrower than those associated with the group one sites. This does not imply that they are all contemporary, but that there is no evidence for one phase of route ways falling out of use and being replaced by another after a considerable period of time. Thompson (1938 p.197, Fig. 3, Fig. 5), noted features which he referred to as "irrigation ditches" associated with three of these sites (pinpointing the exact three based on his descriptions is difficult), which he assumed were likely supplied by rainfall. These features were in fact hollow ways and while his interpretation of their primary function is incorrect, he makes some useful observations of their metrics and relationship with the level of the plain and the river valley to the north. He notes that one of these ditches (possibly associated with GWS_26 or GWS_42) was at least 10m wide, and bifurcated near the Kal Aji, entering the river valley about "ten feet (c. 3m) below the level of the plain – the elevation of the highest and therefore oldest river terraces. While this fact, in itself, does not establish definitely the age of the ruins, it does give a clue to their relative antiquity" (Thompson 1938 p.198).

The project team suggested previously that GWS-26, GWS_27 and GWS_42 were connected by hollow ways, as were GWS_25 and GWS_41, indicating contemporaneity at some point in their occupation (Wilkinson et al. 2013 p.48). The connection between GWS_26 and GWS_27 is strengthened by their dating (both contained recognizable Iron III ceramics, but may also have both been occupied in the Iron IV period – see Table 6-15 and Table 6-3 comparing pottery types; see also Fig. 6-25). GWS_42, is indirectly linked by hollow ways to GWS_27 through a hollow way radiating out from a depression immediately south of a small square mounded feature to the south of GWS_26. The hollow way running from this feature to GWS_42 travels immediately past the rather indistinct edge of GWS_26 and may run through the outer mounds on the east side of the site, but this is far from clear. The possible contemporaneity between GWS_25 and GWS_41 appears to be supported by the dating of GWS_41 in other datasets (Abbasi 2011 Map 10). GWS_41 is also interesting in that it does not appear to have radial hollow ways, but one route leading to it from GWS_25 and another leading almost directly north for at least 2 km (See Fig. 6-25).

The remains of what appear to be small rectilinear fields are visible surrounding the majority of these sites, but these are difficult to date with certainty (Wilkinson et al. 2013 p.48). While some are roughly on the alignment of the much larger, modern field boundaries, some, such as in the vicinity of GWS_42, may be on the same alignment as several of the hollow ways. Unlike the group one sites in this sub-zone to the west, there appears to be limited evidence for a substantial Islamic and more specifically Middle Islamic horizon and the majority of sites appear to have been occupied up to the Parthian period (for a discussion of a possible exception - GWS_25 - see chapter 7). A clear episode (of perhaps a considerable length) of occupation can therefore clearly be defined sometime between the Later Iron Age and Parthian period.

6.2.4 SETTLEMENT MORPHOLOGY AND SITE DISTRIBUTION IN THE SOUTHERN GORGAN PLAIN

While a picture of significant settlement and landscape investment in the late Iron Age is beginning to emerge for the landscapes to the north of the Gorgan River, the limited coverage of the *GWS* to the south of the river (along with poorer preservation on the CORONA imagery due to later land use practices) provides us with a limited understanding of the settlement patterns and land use in the southern half of the plain. Excavations at sites, such as Tureng Tappeh (KH_123), Yarim Tappeh (KH_79), and Narges Tappeh (HUS_19) indicate occupation in the Later Iron Age through Parthian periods, though only at Tureng Tappeh can we confirm occupation contemporary to the *GWS* Iron III period (Abbasi 2011; Cleuziou 1985; Crawford 1963). However, pottery parallels to the IV A phase at Tureng Tappeh (KH_123) was noted on “neighbouring sites” by the Tureng Tappeh team in informal site visits (Cleuziou 1986 p.241), and have been observed by the *GWS* team in more recent survey work[18].

The Abbasi (2011 Maps 9, 10, 14) maps attribute c. 332 sites to the Iron III/IV period, a third more than that attributed to the Early Bronze Age, and slightly more than the amount attributed to the whole Islamic period. This suggests a significant increase in the number of sites on the plain beginning in the late Iron Age. The combining of the Iron III and IV periods however in that dataset makes it difficult to ascertain the specific timing of this surge. However, Priestman (2013 p.524) observed that the rolled and flattened rim jar from Tureng Tappeh VB-C that was used as a marker for *GWS* Iron IV was very common on sites across the plain based on studies of a sample of the survey assemblages collected by our Iranian colleagues[19]. Ceramics traditionally associated with the Parthian period, are also found on a significant number of sites. Kiani (1982b p.64) indicates that red wares, including types of the “céramique sonore” family (including the flamed bichrome wares) were widespread across the plain, and the four sites visited by the *GWS* to the south of the Gorgan River with Iron IV material (GWS_31, GWS_32, GWS_33 and GWS_34) also had bichrome wares noted at Tureng Tappeh VB-C, Yarim Tappeh X, and Narges Tappeh II and associated mainly with the Parthian period (Abbasi 2011; Boucharlat and Lecomte 1987; Crawford 1963; Haerinck 1983; Wilkinson et al. 2013 p.120–121) (see Table 6-3). While further intensive survey is needed, it appears likely that the southern part of the plain was densely occupied throughout the Iron IV (and probably Parthian) periods. Fig. 6-31 illustrates sites attributed to the Iron III through Parthian periods from all data sources).

Patterns in site morphology associated with Late Iron Age through to the Parthian period settlement are also less clear in the southern part of the plain. This is due to preservation,

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[18] This work is ongoing and will be published at the completion of the current ERC funded project in conjunction with our Iranian colleagues.

[19] It is hoped that this material will soon be published in conjunction with our Iranian colleagues and help to further refine the comparability of the above survey assemblages.

the significant number of sites with multi-period occupation, and possibly differences in settlement forms and land use practices in different environmental zones. A possible example of a site type reminiscent of the Iron III through Parthian morphology noted in the landscapes in the northern part of the plain, can be found at the site of GWS_55. While located on the CORONA imagery, the site was not visited in the field (Wilkinson et al. 2013 p.125). On the imagery, the site is most notable for the large square enclosure and square corner citadel reminiscent of several larger rectilinear enclosures on the plain dated to the Sasanian period (see chapter 7). However, it also contains a central qal'eh around which some anomalies were present; on an aerial photo taken by Schmidt in 1937 (and therefore several decades prior to the CORONA image) a clear empty space is visible around the central qal'eh, beyond which mounded features are visible, possibly even forming structures (Fig. 6-28). While the dating of the qal'eh, mounds, and enclosing rectilinear structure are open to debate, this site may represent an example of a site similar in morphology to Qelich Qoineq (GWS_16) or GWS_15 incorporated into a later rectilinear enclosure.

While the main mound (c. 1.5 ha on the CORONA imagery) at Tureng Tappeh (KH_123) has received the most detailed investigation, Wulsin and Smith (1932 p.3, see also plate 1) described the site as "a group of mounds interspersed with ponds and water courses. The whole group is about half a mile in diameter". While a clear site morphology as seen at Qelich Qoineq (GWS_16) or other sites farther to the north is not apparent at Tureng Tappeh (KH_123) on the CORONA imagery, the aerial photos of the site taken by Schmidt (1940 Plates 70, 71) in the 1930s also suggest the presence of some low outer mounding and he says of the site "lower town deposits extend from the fortress hill in all directions" (Fig. 6-29). However, there is no available ceramic data to indicate whether or not any of the mounding beyond the main tappeh was occupied in the same phase as period IVA. Equally, occupation continued beyond period IVA at Tureng Tappeh, and this may have had an impact on the observable morphology of this site. Several scholars have also suggested that other small prominent multi-period tappehs with Iron Age material, such as at Yarim Tappeh (KH_79), may also have had surrounding settlement characteristic of this pattern (Cleuziou 1986 p.241; Mousavi 2008 p.110), but this is not something that can be confirmed on the imagery. Narges Tappeh (HUS_19) (c. < 1 ha on the imagery), another example of a small prominent tappeh, was also clearly occupied between the Late Iron Age and Parthian periods, but appears to post-date Qelich Qoineq (GWS_16) based on the illustrated ceramics (Abbasi 2011).

While no sites with Iron III ceramics were noted by the *GWS* to the south of the river, GWS_31, GWS_32, GWS_33, GWS_34 all appeared to have been occupied in the Iron IV period. Not surprisingly GWS_31, GWS_33 and GWS_34 were occupied in earlier periods, and in the case of GWS_31 and GWS_33 also occupied in later periods (see Table 6-1, and 6-2). It appears that already extant prominent mounds were favoured for occupation in the southern half of the plain. No clear examples of outer mounding similar to that seen on the sites to the north of the river can be seen at these sites (Fig. 6-30). However, this may again be due to modern land use practices. At GWS-31 (Bibi Shirvan) for example, the extent of the site is not clear on the imagery, but Kiani (1982b p.60) suggested that the lower town covered an area of at least 200 ha. How much, if any of this, was attributable to the Iron IV period is unknown. In general, however, it is interesting to note is that the size of the mound/qal'ehs at these sites are generally larger (c. 2 and 5 ha in size), than those in the northern half of the plain. Overall, a wider range of morphologies may have existed in the Iron IV (or even Iron III?) period in the southern half of the plain, but this is particularly difficult to determine due to later land use and settlement activity.

6.3 SETTLEMENT MORPHOLOGY, SUBSISTENCE STRATEGIES, AND SOCIO-POLITICAL ORGANISATION - THE CASE OF QELICH QOINEQ

The evidence discussed above suggests that by sometime in the late Iron Age settlements of significant size, inhabited by communities likely engaged in subsistence strategies involving either dry farming or irrigation agriculture, and pastoral activities had been founded in the semi-arid landscapes to the north of the Gorgan River. In general, this pattern continued, certainly with variations not apparent on the macro scale, through to likely the Parthian period, but ended at least by the time the Gorgan Wall was built in the 5^{th} century AD.

To further explore the relationship between site morphology, subsistence strategies, environmental sub-zones and socio-political organisation, I will take a closer look at the site of Qelich Qoineq (GWS_16). This will involve an examination of the evidence available from site survey and excavation. The shift in scale, from the regional to the site-specific, offers the opportunity to compare the evidence for occupation at this site, with the evidence available for morphologically similar sites in other regions. This will also provide us with a jumping off point from which to examine the development of settlement systems from the Late Iron Age through the period of the Persian empires.

Qelich Qoineq (GWS_16) is located 2 km north of the Gorgan Wall and c. 13 km north of the modern Gorgan River within the western steppe (see Fig. 6-3). A multi-scalar and multi-technique approach was taken to investigations at the site that involved the remote sensing of modern and historical satellite imagery, extensive ceramic collections, geophysical and topographic survey, and targeted excavation (Sauer et al. 2013 p.407–421). A topographic survey was carried out over a roughly 13.5 ha area on the western side of the site extending from the central qal'eh to the outer wall. A geophysical survey was conducted over 9.5 ha of the same area[20]. What were interpreted as streets and buildings were clearly visible on the geophysical plot and correlated, in the main part, with the mounds visible on the topographic survey and to a slightly lesser extent on the CORONA imagery (see Fig. 6-32). These investigations seemed to confirm that a substantial outer settlement had existed around the central qal'eh beyond the flat area/depression.

The focus of the outer mounds around the central qal'eh clearly indicates its priority in the sequence of settlement formation (see Fig. 6.33). The layout of the central qal'eh (measuring c. 40 x 30 m in field) being un-excavated, is impossible to discern, particularly as the geophysical survey does not appear to provide a clear picture of any construction on the mound; however, its slightly dish-shaped interior is of course suggestive of a fortified mound. The wide (c. 70-80 m on the CORONA imagery) space or depression beyond the qal'eh may have been formed by the extraction of earth for the chineh (packed mud) or mudbrick for its construction (Sauer et al. 2013 p.407–408; Wilkinson et al. 2013 p.57). While we do not know the construction material of the qal'eh, pakhsa (the word used for chineh in parts of Afghanistan) is used for the construction of qala, or traditional fortified farm complexes in Afghanistan, and the material is usually taken from a circular area immediately surrounding the qala (Szabo and Barfield 1991 p.143). Examples of enclosed depressions that likely supplied building material for Bronze Age tell sites are also common in Northern Mesopotamia (Wilkinson 2003 p.109).

[20] The geophysical survey was carried out under the direction of Roger Ainslie of Abingdon Geophysics, and Mohammed Ershadi and Stephen Usher-Wilson of the Gorgan Wall Project. Further details for the methodology and results can be found in Ainslie (2008) and Sauer et al. (2013 p.408–411).

What was the function of this space? It is likely to have served multiple practical and symbolic functions such as for the keeping of animals, a place of refuge in times of threat, a space for community activity, as well as augmenting the prestige of the central qal'eh perhaps as an elite residence (Sauer et al. 2013 p.407; Wilkinson et al. 2013 p.57). This is even more likely, if the traces of a wall noted on the east side of the flat area in the field survey constituted an enclosure wall surrounding the qal'eh and depression (Wilkinson et al. 2013 p.116). While of a different size and morphology, some of the Iron Age *kala* type settlements that are characteristic of Khwarazm such as Kalaly-Gyr 1 and Kiuzely-gyr, have considerable areas of empty space within the walls that may have also functioned as enclosures for cattle and sheep, and perhaps even for people and animals in times of conflict (Negus Cleary 2007 p.11; Negus Cleary 2013 p.87). Furthermore, at Middle Banesh period (c.3250-2950) Tal-e Malyan in southwest Iran, there were considerable open areas (ca. 100 ha) within the walled settlement that it was speculated may have provided a secure place for mobile pastoral groups and their herds seasonally (Alden 2013 p. 220-221, Fig. 12.4). Furthermore, after the outer mounds of the settlement had grown up around the qal'eh and the outer wall was built, this central area could still have been used for this purpose. Its use as a water-filled defensive moat was also proposed, and while water may have collected in the depression seasonally (there is no evidence for water supply other than rain to fill it) (Sauer et al. 2013 p.407), without excavations to tell us the depth of this feature it is difficult to ascertain if it would have formed an effective barrier. However, this does raise the issue of seasonality; use of this space, for the corralling of animals for instance, may have been limited to particular seasons.

Beyond the depression, the extent of all of the visible mounds at Qelich Qoineq (GWS_16) were mapped by Seth Priestman (2013 Fig. 18.37) during an intensive surface survey and ceramic collection (Fig. 6-33). If we use this data to calculate the area covered by mounding across the site, it is equal to c. 25 ha; this includes the central qal'eh, but excludes the outer wall. This figure, of course, does not take into consideration any levelling of the mounds due to modern agricultural or building activities. Indeed, a comparison of the CORONA imagery and imagery available on Google Earth would seem to indicate the attenuation of mounded features between the 1960s and the present day, particularly on the eastern side of the site; this was also clearly apparent in the field (Fig. 6-34). Furthermore, visual inspection of exposed sections through the outer mounds of sites in the western steppe indicated that they were composed of a substantial amount of loess, which may have resulted from the decay of architectural features or the accumulation of loess or silt-clay aggregates from the local environment (Tony Wilkinson pers. comm. 2008). As such, the degradation of the rammed earth and mudbrick architecture and the accumulation of sediment have likely caused some of the mounded areas to spread out beyond their original extents.

The areas of the mounding seem to roughly correspond to the areas covered by the anomalies recorded in the geophysical survey, though the features on the geophysical plot appear to cover slightly more area than the mounding (Fig. 6-35). For the 8 ha area of the site that was covered by both the geophysical survey and the ceramic collection (excluding the central qal'eh and outer wall), anomalies on the geophysical plot cover c. 4.6 ha. This of course may be generous as not all of the anomalies on the imagery will represent the area covered by the original structures. For the same area, the mounds recorded in the ceramic survey equate to c. 2.5 ha. If we therefore assume, as a rough estimate, that the extent of the architectural features at the site covered c. 50% more than was represented by the mounding mapped in the surface survey, then excluding the outer wall and mound, the features visible on the geophysical survey could have covered an area up to c. 36 ha. If we included the area of the qal'eh, this would add an additional c. 0.5 ha. Further adjustments could be made to try and take into consideration the wall and possible associated architecture, or mounding that may no longer be extant, but this is difficult based on the imagery and little would be gained. Even with rough figures, and assuming contemporaneity of these features, it is clear that within the c. 80 – 87 ha assigned for the site, perhaps only half, or if generous, two-thirds of the site represents settled area if based upon the presence of architectural features.

If this were the case, and we assume a population density of between 100 and 200 people per ha[21], the site of Qelich Qoineq (GWS_16) may have been able to sustain a population between c. 4300 to 11400 people assuming contemporaneity of visible structures at its greatest extent. Higher densities may also be posited. However, population densities calculated in this way may not be very accurate, and actual figures may be considerably lower if not all anomalies in the geophysical survey are contemporary structures, or if settlement density was different on other parts of the site.

[21] Based on population densities attested by ethnographic studies across the Near East (Adams 1965 p.24; Johnson 1973 p.66; Sumner 1989).

This patterning of outer mounds around the depression, with the mounds forming discrete areas as opposed to continuous occupation[22], is similar to that described for the Archaic Dehistan sites of southern Turkmenistan. Within these settlements, a low density of settled area is also apparent; for example, at Madau-depe, only 80 of the 224 ha total site area were recorded as representing mounding or architectural features (Kohl 1984 p.202). This type of spatially discontinuous, low density site, or "non-nucleated" settlement is a common feature of Central Asian oasis sites from Khwarezm to Merv (Hiebert 1992 p.111–113; Hiebert 1994 p.28; Lamberg-Karlovsky 1994; Lecomte 2005 p.462; Negus Cleary 2007 p.18).

The mounding surrounding the qal'ehs at the Archaic Dehistan sites have been interpreted as representing agricultural settlements (Lecomte 2007 p.72). A similar pattern of outer buildings including residential, farms or production areas dispersed around a *kala* is also characteristic of Iron Age sites in Khwarezm, such as the site of Ayaz-kala 3 (Negus Cleary 2007 Fig. 13.3; 2013 p.91–92). Can we characterize the outer mounds at Qelich Qoineq (GWS_16) similarly?

6.3.1 THE OUTER SETTLEMENT AT QELICH QOINEQ

Further information on the outer mounding surrounding the main qal'eh at Qelich Qoineq (GWS_16) was obtained through the excavation of sounding. An analysis of the results of this excavation provides us with the opportunity to explore the relationship between site morphology, and agricultural and pastoral practices in more detail, and compare this to information available from chronologically and/or morphologically similar sites in other regions.

A 4.5 x 5 m sounding (Trench P) was placed over one of these outer mounds at Qelich Qoineq (GWS_16) identified in the geophysical survey as having architectural features (see Fig. 6-33). A brief summary of the excavated sequence from Trench P is presented below based on a more detailed description offered in Sauer et al. (2013 p.411–418). The earliest cultural deposits (P.024, P.022, P.0.17/P.026/P.051) appear to have been of short duration judging by their depth (less than 20 cm each) and contained pottery and bone, but no evidence for architectural features. P.024, P.022 are separated from P.0.17/P.026/P.051 by

[22] No ceramics were apparent between the mapped mounds in the intensive surface survey, though accumulation of sediment in low areas was visible (Priestman 2013 p.512–514).

a period in which a c. 25 cm layer of fine sand was deposited. Following these ephemeral layers, deposits interpreted as possible platforms, and occupation layers containing traces of daub were recorded. Chineh or packed earth walls (P.028 and P.041) were next encountered and appeared to match those detected in the geophysical survey; these were the earliest traces of definitive architecture within the sounding. They had very diffuse boundaries and were hard to identify in the excavation but were more easily located in the sections. The deposits (P.013/P.019) encountered within the structure (P.028 and P.041) were interpreted as either occupation layers, or post-deposition layers subsequent to its abandonment. A later mud-brick wall (P.027) was built on top of deposits in the interior of the structure indicating later use of the building.

Occupation of the area covered by the sounding continued on and off for the rest of the sequence as evidenced by the cultural materials, both before and after the chineh walls were covered by the accumulation of settlement, though no more architectural features were encountered; however small amounts of burnt daub were recorded and deposits with frequent lime inclusions may have represented further degraded chineh structures. Taking into consideration the radiocarbon dates, spanning a maximum of 375 years between the 8th and early 5th century BC[23] (with the earliest date coming from context P.024 and the latest from P.004, the latter of which clearly covers even the highest traces of the chineh and mudbrick architecture) and the stratigraphy of the site, it would seem that this sequence may have occurred over only two or three centuries (Sauer et al. 2013 p.418) (Table 6-16; Fig. 6-36). While deposits subsequent to the latest radiocarbon date may extend the period of occupation of the area of the sounding beyond the maximum possible range there was no change in the pottery to suggest occupation continued into a later period (Sauer et al. 2013 p.420). Indeed, the almost complete lack of change in the ceramic assemblage throughout the excavated sequence and from the surface survey (Priestman 2013 p.517, 520, Table 18:15) seemed to suggest that the relatively short life-span of occupation at Trench P was symptomatic of the entire site.

As such, the above sequence was interpreted as representing initial repeated large-scale occupation by nomadic groups, with the subsequent platforms interpreted as phases representative of a transition to more sedentary occupation, followed by a short-lived town

[23] The date range provided by the radiocarbon dates cannot be refined any further due to a radiocarbon plateau between the 8th and 6th centuries BC.

phase represented by the level of the chineh walls. Later reuse of this structure occurred, and other settlement activity was clearly noted in the area, but it was not seen to represent the same permanence or scale of settlement as the chineh walls (Sauer et al. 2013 p.417–420). The apparent rapid nature of the transition from 'nomadic' to 'urban' site was suggested to have been made possible by a strong centralized political authority (perhaps the Medians or Achaemenids, or an even earlier entity) that could have regulated or introduced canal irrigation (i.e. the North and South Canal), enhanced by the assumption that the site could not have existed in the western steppe without it (Sauer et al. 2013 p.420).

However, there is a contradiction between the layout of the site and a short fully-fledged 'urban' phase that was touched upon in the original site report: "It is odd that a town, whose outer circle of housing is somewhat irregular, suggesting (except for the nucleus) a lack of central planning, appears to have been built in a single phase" (Sauer et al. 2013 p.418). This assumption that the 'town' phase of the site was confined to a single short-lived sub-period of the site's existence was suggested by the excavation in Trench P in which only one phase of substantial architecture was encountered that matched the orientation of features (interpreted as walls) on the geophysical plot. As such, it was assumed that all of the architectural features visible on the plot were of the same sub-phase, and by extension this pattern could be extrapolated over the entire site area. However, without wider spatial exposure, it is impossible to confirm this. There is discontinuity between a single town-like phase and the more organic pattern of settlement growth suggested by irregularity of the outer mounds. While it is true that no superimposition of one phase of architecture over another is clearly visible (though this may be difficult to tell at the resolution of the image) there is the possibility of spatial stratigraphy. This does not suggest a haphazard arrangement of structures with no organizing principle, but instead "planned organic growth", expressing ideas of "standardization" and the "coordination of space" but in a less formal, decentralized manner (Isendahl 2012 p.1122).

A more gradual development of the architectural phases of the site, involving spatially and temporally discontinuous settlement expanding outward until the point in which the site was walled (when perhaps a significant portion of it may have been occupied) may have occurred, and simply not been visible in the limited exposure provided by Trench P. Indeed, the traces of daub, and perhaps degraded chineh architecture throughout the sequence suggest buildings nearby. We should perhaps then be cautious in assuming that the events occurring in Trench P (representative of less than 1% of the site area) were occurring contemporaneously site-wide. Furthermore, the uniformity in the ceramics from both the excavations and the surface survey, does suggest that occupation was confined to a single ceramic horizon, but it is possible that the range of radiocarbon dates returned from Trench P may not represent the entire life-span of the site.

Parallels have already been drawn between the ceramic assemblage and spatial layout of Qelich Qoineq (GWS_16) and the Archaic Dehistan sites in the Misrian Plain. However, significant problems in discerning change in the forms or fabrics of the Archaic Dehistan ceramics, despite the identification of different building phases, and considerable deposits (up to nearly 7m in some cases) were encountered at the sites of Madau Depe, Izat Kuli, Tangsikil'dzha and Benguvan in the Misrian Plain. The only variations noted were in the spatial distribution of certain colours of ceramics, and a possible change in the percentage of grey to red wares through time (Cleuziou 1986 p.240; Kohl 1984 p.203–205; Lecomte 2009 p.73). Furthermore, the reported radiocarbon dates from two of these sites (Tangsikil'dzha and Benguvan)[24] imply dates for the Archaic Dehistan sequence between the mid-2nd millennium (1670-1420) to c. 6th century BC (Voigt and Dyson 1992 p.158; Kohl 1984 p.200). A radiocarbon date from Geoktchik Depe, also in the Misrian Plain, (1250-925 at 2 sigma or 1135-1000 at 1 sigma) furthermore falls within this range; based on the stratigraphy from these excavations and finds (notably an arrow head), Lecomte (2005 p.466–467) has argued that the Archaic Dehistan Phase extended from 13th – 6/5th centuries BC that could extend it to a period contemporary with occupation in Trench P at Qelich Qoineq (GWS_16). The ceramic assemblage at Qelich Qoineq (GWS_16), clearly related to the Archaic Dehistan ceramics, may suffer from a similar lack of identifiable change through time.

Unfortunately, there is little that we can say about the function or use of space between or within the structures and buildings that form these outer mounds at Qelich Qoineq (GWS_16) with such little spatial exposure. Sauer et al. (2013 p.408) interpreted the empty

[24] Voigt and Dyson 1992 report sample LE1051 from Benguvan Lower as 3230 ± 50 (5568 b.p.), 3320 (5730 b.p.), 1670-1420 (CRDª 1 σ B.C.); Kohl (1982:200) reports two uncorrected radiocarbon dates, one for the top level of Tangsikil'dzha – sample LE 1051 (590 ± 50 BC) and one from a lower level at Benguvan (1280 ± 50 BC).

spaces between the architectural features visible in the geophysical survey as squares, but this again assumes contemporaneity of all visible features. The evidence from the intensive surface survey appears to indicate little to no change in form or function across the site, or between the mounds that were surveyed, and as such temporal variation or activity areas cannot be discerned. Though this could be partly due to the sampling technique, the size of the sample or the effect of ploughing activity on the distribution of artefacts (Priestman 2013 p.517).

This same lack of change in form or function is also notable in the excavated sequence (Sauer et al. 2013 p.518). The chineh walls (P.028 and P.041) representing the most substantial architectural features in Trench P were originally interpreted as a domestic structure, but with limited information for activity within the structure it is difficult to interpret its function. Small flat-roofed chineh houses are common in parts of Afghanistan, (Szabo and Barfield 1991 p.135–137), but Chineh or Pakhsa walls are commonly used, for non-load bearing structures such as courtyards and animal pens in parts of North East Iran and Turkmenistan (Hermann 1999 p.48; Horne 1994 p.133). For example, the structures within the citadel at Chiglik-depe (though surrounded by an exterior pakhsa wall) were constructed of mudbrick; as were the rooms excavated on the outer mounds at another Archaic Dehistan site, Madau Depe (Kohl 1984 p.204–205). The reuse of the chineh structure in Trench P at Qelich Qoineq (GWS_16) and the addition of a mudbrick wall at a later date suggests the use of both mediums at this site as well and could indicate multiple uses for the structure located within Trench P.

So while in many ways, Qelich Qoineq (GWS_16) also exhibits similar spatial patterning to the Archaic Dehistan and other fortified sites with extramural settlement in Central Asia, we can at present say little about the nature of this external settlement. Another key difference in settlement morphology to some of the examples listed above is that, for the Archaic Dehistan sites in particular, there are no examples in which the outer mounds are enclosed within ramparts (Lecomte 2009 p.72). The walling of the entire site of Qelich Qoineq (GWS_16), of course, presents an interesting episode in its development, and suggests the desire of the community to protect against an external threat, but could equally have been for penning animals, or to affirm the status of the site over others in the area. The building of the wall appears to have ended the outward expansion of the site, but did it signal the beginning of the end of the site's occupation? Without knowing the date of the wall's construction, it is difficult to place it within the sequence of events occurring in Trench P, and they could be chronologically disparate. While the wall may be contemporary with a point when the site was at its most densely occupied, all we can say is that it likely equates to the maximum spatial extent of the site. The substantial amounts of pottery pulled out from the upper levels of the sequence (see Priestman 2013 Table 18:16) suggests continued occupation of the site on a similar scale despite the apparent lightly built nature of many of the structures in Trench P following the 'substantial architectural phase'. While many of the qala type enclosure sites of the Khwarezm appear to have little in the way of internal architecture (but considerable fortification walls and citadels), several examples, such as the site of Kiuzely-gyr in Khwarezm had internal features including a few mud-brick buildings, traces of wattle and daub structures, and structures along the inside of the fortification walls prompting Negus Cleary (2013 p.93) to suggest that more ephemeral types of structures may have been present at other sites. This suggests that substantial wall or fortified mounds (such as the central qal'eh) does not necessarily equate with substantial architecture on the rest of the site.

6.3.2 'NOMADIC' AND 'URBAN' - SUBSISTENCE STRATEGIES

The use of dichotomous labels such as 'nomadic' vs 'urban/town' (implying a primarily agrarian centralized polity) to describe phases within the Trench P sequence, and by extension across the entire site are not wholly supported by the excavation and survey data. Part of the problem here might also lie in terminology. The use of the word 'nomadic' to describe the earliest and latest layers in Trench P is potentially misleading. Nomadism implies long distance movement, and a particular subsistence strategy. Indeed, the possibility for seasonal or semi-permanent habitation of parts of the site throughout its occupation can be considered, but we should perhaps be careful in equating a lack of architectural features on one small part of the site with a specific subsistence strategy, or using the word 'nomadic' as a catch all. Equally, with our inability to determine the area or density of settlement at the site at any one moment, the evolutionary progression from nomadic encampment to sedentary agricultural town and back again appears somewhat simplistic.

It was previously speculated that the qal'eh, being the first part of the site constructed, may have formed a central place, perhaps a seat of local power that attracted settlement in its vicinity (Wilkinson et al. 2013 p.58). Indeed, its location in a flat, steppe landscape would have made it one of the most prominent features for a considerable distance. But what kind of settlement did it attract? Rapid or gradual sedentarisation events are recorded in ethnographic contexts for either parts of, or entire mobile pastoral groups. For an individual or family unit this is usually the result of wealth or poverty (a rich mobile pastoralist converting wealth into property, or a poor one being absorbed into a village community as an agricultural labourer; times of political stability generally reflect a trend toward sedentary life, with times of instability causing movement along the spectrum toward nomadism (Barth 1964 p.106–126, 116–188). We could also posit a situation in which the site was used seasonally (perhaps as part of a pattern of transhumance), and gradually became a locus for more permanent occupation. However, with our current inability to look at settlement across the site at any one time, it may be difficult to be too specific about the mobility of the site's earliest inhabitants.

The data from the faunal analysis of the materials recovered from Trench P can provide some further, though chronologically limited insights. These remains were studied in two chronological groups. The first represented everything from contexts that were stratigraphically earlier than the latest radiocarbon date from context P.004 (761-416 BC at 95.4% confidence) (see Table 6-16). This included samples from the earliest ephemeral occupation layers, the 'urban' phase, and later periods of reuse. The second group represented the samples from the uppermost layers of the site (namely contexts P.002 and P.003) (Mashkour 2013 Table 20:17). In the former group, suids, both wild boar and domestic pigs, appear to be as important to the diet of the site's inhabitants as caprids and bovines (Mashkour 2013 p.566, Table 20:23). Interestingly, at Geoktchik Depe, in the Misrian Plain, suids also increase in importance for the supply of meat in the Archaic Dehistan period (Mashkour 1998 p.201–202; Mashkour 2013 p.539).

Wild boar indicates that hunting, likely in riverine habitats where dense reeds and thickets provide cover for the boar (Mashkour et al. 2013 p.225) as may have been found on the banks of the Gorgan River. Perhaps more significantly for this discussion, however, is the presence of domestic pigs, suggestive of a subsistence strategy that does not solely involve continuous long distance movements and good access to water (Mashkour 2006 p.158). Because the data for this chronological group come from the earliest layers of Trench P right through to the phases post-dating the chineh structures, however, it is currently difficult to trace any changes in the proportion of species through time or interpret it against the stratigraphy of the site. If the earliest layers of activity were to show a greater reliance on caprids, then it is plausible the site's inhabitants were more heavily reliant on strategies involving pastoral mobility in the earliest levels, making a stronger argument for a shift in subsistence strategies based on the architectural remains. This line of inquiry will hopefully be explored in conjunction with our faunal specialist in future. Interestingly, though, analysis of the samples of the latest chronological group (post-dating the architectural remains in Trench P) appeared to indicate that caprids became more abundant than suids or bovines, but that the latter two were still present in lesser quantities. This does appear to support, at least for the most recent occupation of the site a shift toward a reliance on herd animals, but without further evidence we cannot surmise a range of mobility. However, the fact that pig still remains part of the diet of the inhabitants, suggests an agro-pastoral, or mixed subsistence economy. Equally, we are again basing these interpretations on the bones recovered from one small area of the site. A wider sample would prove more illuminating.

It is difficult to comment on changes in the types and quantities of animals bones from the earliest occupations in Trench P through the levels of the chineh structure. The evidence from the later periods of occupation at the site suggests that while there were changes in the ratios of species (and potentially pastoral practices), a strict linear progression from 'nomadic' to 'sedentary' and back again may mask the variations in subsistence strategies through time.

The interpretation of an urban or town phase of the site was also linked to the presence of field systems in its vicinity, and the possible association with the North or South Canal. Because of its location in the steppe, and the assumption that the subsistence economy was primarily agricultural in at least its 'urban' phase, it was supposed that the site could not exist where it did without such irrigation systems. Equally, the construction and coordination of these systems was assumed to have been accomplished through a centralized political authority (Sauer et al. 2013 p.420). This interpretation is not dissimilar to the Soviet interpretation of canal systems in Khwarezm (Negus Cleary 2013; Stride et al. 2009), or a Wittfogelian (1957) model, in that canal systems were seen as needing a large labour force organized by a centralized agrarian state. In the case of Qelich Qoineq (GWS_16), the implication was not that the need for irrigation resulted in centralization and oriental despotism, but that a powerful polity would have been needed to not only construct and maintain canal systems, but to oversee the founding of 'town-like' settlements in the more arid regions north of the Gorgan River. The possibility that this settlement expansion may have coincided with the establishment of hegemony over the plain by a Median polity or the Achaemenid Empire was suggested, though earlier origins were also noted as conceivable (Sauer et al. 2013 p.420). The radiocarbon dates do not allow us to differentiate between a pre-Median, Median or Early Achaemenid period date, but the similarities in ceramics and site morphology to the Archaic Dehistan sites lends support to a date in the earlier part of this sequence.

The fact that the radiocarbon dates and the stratigraphy of the site might indicate that the earliest occupation at Trench P predated any Median or Achaemenid influence did not, in this interpretation, preclude that an earlier centralised authority may have been responsible for the establishment of the urban-phase of the site on the location of previously ephemeral occupation. Sauer et al. (2013 p.420–421) therefore presents the option that the site, perhaps rather rapidly, transitioned from a nomadic camp to an urban site (implying the catalyst was external pressure), or that the location, formally a camp, was selected as the site for a city when the strong political entity came to rule to the plain and could ensure security for agricultural investment in the more arid steppe. However, this assumes several things:

- That there is a disjuncture between a nomadic phase and an urban phase at the site, but clearly defining such phases based on the density of architectural features may be difficult without excavation over a wider area
- A strong centralised authority is required to construct and maintain canals
- A site of this size could only exist in the semi-arid western steppe with the aid of irrigation, however, this assumes a primarily agricultural economy. Indeed, the presence of pigs in the faunal record implies good access to water; however, without a more detailed chronological breakdown of the faunal remains it is difficult to ascertain if pig were important in the diet of the site's inhabitants from the beginning of the site's existence.

A more gradual development of the site, though perhaps only over a few centuries, in harmony with a lack of top-down centralised planning displayed by the overall site plan appears plausible. Whether the site ever deserved the label 'urban' is difficult to ascertain, and may ultimately be immaterial to the current argument. On one hand, we are lacking features of urbanism in the sense of the traditional Near Eastern city (i.e. Childe 1936) – we cannot clearly define production areas, or differences in the use of structures, though this may change with future fieldwork. Furthermore, the layout of the site may speak to spatially or even chronologically discontinuous settlement as opposed to dense occupation. On the other hand, low density urbanism, and its various forms (i.e. agro-urban landscapes etc.) have received much consideration in recent scholarship, and may provide alternative models to be applied when more evidence is available (Fletcher 2011; Isendahl 2012; Lawrence and Wilkinson 2015; Lucero et al. 2015). While the site may have undergone a generally speedy expansion over only a few centuries, we cannot verify the incorporation of the plain into a large polity or territorial empire and that this resulted in the rapid formation of an urban centre at the site. Furthermore, it is important to remember that Qelich Qoineq (GWS_16) is only one of many potentially contemporary sites on the plain (and furthermore only one of a number of morphologically similar sites within the western steppe zone), and its role in the settlement hierarchy of the period has not yet been established.

The assumption that the presence of canal systems either results in, or is a consequence of a strong centralised political entity (i.e. an agrarian state) (e.g. Kohl 1984 p.208) should also be dispelled. A number of scholars have rejected this association particularly in a Central Asian context (Lecomte 2009; Negus Cleary 2013; Stride et al. 2009). Stride et al. (2009) for example have demonstrated in the vicinity of Samarkand, the development of an irrigation system from the adaptation of small channels running down from the mountains into a large scale irrigation network – "it is thus possible to postulate a progressive construction of the irrigation network over the long term, without the existence of an initial master plan or a centralised political decision". As we cannot yet ascertain to which phase of the canal systems on the western steppe, if at all, Qelich Qoineq (GWS_16) was contemporary with, a similar development could be postulated; indeed, the presence of several palaeochannels and possible canal features in the vicinity of the site, or the evidence for phasing of the North Canal (see section 6.2.1.2) may indicate progressive development of these systems. This does not preclude that the organization and maintenance of irrigation systems by a polity like the Achaemenid Empire did not occur at some stage, but that this would not have been needed for the initial construction or maintenance of canal systems.

The location of Qelich Qoineq (GWS_16) in the semi-arid western steppe, the size of the site in its 'urban' phase, associated field systems, and the possibility of it being supplied by canal irrigation was taken to imply the primacy of an agricultural economy. While the idea of centralized control was later rejected by Lecomte (2009), the presence of irrigation canals, still led to the implicit assumption that the subsistence economies of the Archaic Dehistan sites were also primarily agricultural. However, it is important to bear in mind that the water from canals can serve multiple purposes – irrigation, pastoral production (e.g. growing fodder for use in the dry season), or construction activities reflecting the multi-resource nature of many agropastoral communities (Negus Cleary 2013 p.77). Indeed, the manufacture of chineh requires a considerable amount of water; the width and height of traditional qala walls in Afghanistan is directly related to the amount of water available (Szabo and Barfield 1991 p.141). The evidence from Qelich Qoineq (GWS_16) may better reflect a community engaged in a multi-resource subsistence strategy; particularly its location within the semi-arid western steppe, where season availability of water (even with irrigation systems) could greatly affect the success of both agricultural and pastoral activities.

Understanding the socio-political systems that led to the formation of such sites is more difficult to explain. The orientation of the site around the central qal'eh, and the dispersed nature of the settlement around it may be suggestive of a socio-political organization based on the sort of 'Qala' and 'Khan' models proposed by Hiebert (1994) and Lamberg-Karlovsky (1994; 2003) to explain Bronze Age (and later Iron Age and Medieval) oasis settlements of Central Asia, which are differentiated from both the idea of a chiefdom or a state. Citing the example of Medieval Merv, Hiebert (1994 p.176) suggested that the Bronze Age qala sites of Margiana may better fit a model of "land-lord khans" than one of traditional urban sites. At Merv, a qala around which agricultural settlements were arrayed was controlled by a local khan (or dikhan). This peson organized local land and water resources and in turn paid tribute to a regional khan who maintained water systems and production. A similar de-centralised, non-urban model of settlement organization, in which tribal groups controlled their local areas, but coordinated on the maintenance of, for example, water control systems was proposed by Lecomte (2005; 2009) for the Archaic Dehistan sites.

These models emphasized the agricultural role of these settlements, partly because of the visibility of water control systems and the lack of data on subsistence strategies with less tangible signatures in the archaeological record. However, Stride et al. (2009 p.80) for example, have emphasised that the economic importance of irrigation agriculture in the Middle Zeravshan Valley, did not reflect the socio-political structure of the communities living there which were “dominated by an elite of pastoral nomadic” origin.

Another model to consider is that forward by Alden (2013) extending the suggestions made by Sumner (1986b) regarding the relationship between site morphology, subsistence strategies and socio-political organisation at Tal-e Malyan, and the Kur River Basin in the Banesh Period (3400-2700 BC). In this model, ‘settlement clusters’ developed in the Early Banesh period representative of a tribal society engaged in a mixed subsistence strategy involving transhumance and sedentary agriculture, with its socio-political organisation based on segmentary lineages (Alden 2013 p. 225). Of particular interest, however, is the pattern of settlement characterising the largest site in the region, Tal-e Malyan, in the Middle Banesh phase. The substantial areas of walled, yet empty space, interspersed with mounding were discussed previously as a potentially similar settlement layout to Qelich Qoineq (GWS_16). While much larger than, but similar in form to the ‘settlement clusters’ of the Early Banesh phase, Tal-e Malyan is not characterised as a traditional urban centre for surrounding agricultural towns and villages by Alden (2013 p. 226). Instead, due to the lack of evidence for large-scale irrigation systems in the vicinity, he considers that the site may have been a hub for mobile pastoral groups, with both permanent and seasonal populations. While the finer points of the model can be debated, it does not immediately link sites of substantial size with an urban character or a dependence on a primarily agricultural economy.

6.4 DISCUSSION

The Bronze Age occupation of the Gorgan Plain appears to have been characterised by a substantial increase in site numbers in the Early Bronze Age, and a subsequent decrease through the Middle and Late Bronze Age (see Fig. 5-13). However, it is difficult to say without site size data by period how this translates into increases and decreases in total settled area, and overall population. The abandonment of several multiperiod tappeh sites (e.g. Tureng Tappeh (KH_123), Yarim Tappeh (KH_79), Narges Tappeh (HUS_19)) sometime in the latter part of the 3rd or beginning of the 2nd millennium BC, and the almost complete lack of settlement data for the final Bronze and early Iron Age clearly illustrates a significant geographical shift, or decrease in sedentary settlement.

Following the Late Bronze/Early Iron Age settlement minimum, our knowledge of how and exactly when sites representing at least semi-sedentary settlement resumed on various parts of the plain is limited. Radiocarbon dates from one of the outer mounds at Qelich Qoineq (GWS_16) suggest that this part of the site was occupied for a minimum of at least two or three centuries between the 8th and 5th centuries BC (Sauer et al. 2013 Table 14:1, Fig. 14:10). A comparable ceramic assemblage exists at Tureng Tappeh in the earliest Iron Age layers, but without independent dating it is difficult to say whether it was contemporary to Qelich Qoineq (GWS_16), earlier or later. Equally, we do not have enough data to place the Qelich Qoineq (GWS_16) ceramics within that of the Archaic Dehistan sequence. As such, it is difficult with the current dataset to discuss the spatial and chronological relationship of these events at all but a broad level. However, personal observation based on more recent survey work on the plain suggests that Iron III ceramics are frequently found on sites, not only in the steppe margins, but across the southern part of the plain suggesting a significant increase in site number, and population in this period[25].

Migrationist theories, regarding the movement of people in greater northeast Iran, in this period are simplistic and equate pots with people (Cleuziou 1986 p.242–244 for a discussion of this issue). Still, explanations involving the movement of populations to explain the links between the Bronze Age Gorgan grey wares, the Sumbar materials, and the Archaic Dehistan ceramics, are suggested (Lecomte 2009 p.72). Other explanations for the lack of settlement evidence at the end of the Bronze Age through the Early Iron Age may be better starting points. These involve shifts in subsistence strategies (from sedentary agriculturist to mobile pastoralism), or changes in subsistence activities (but not necessarily equating to a shift to nomadism) and the utilisation of more marginal environmental zones (e.g. the Alborz Mountains) (Cleuziou 1986 p.244; 247; Mousavi 2008 p.117). Indeed, more nuanced models allowing for local developments, changes in subsistence activities, and the use of different environmental zones are welcomed.

While it is difficult to add anything new to this debate, the dating information for Qelich Qoineq (GWS_16), coupled with the settlement data gathered through survey, suggests that communities engaged in some degree of agriculture were established in the steppe regions to the north of the Gorgan River at least by the 7th century BC. Even though the

[25] This data is currently being processed and will be published in conjunction with our Iranian colleagues in the near future.

data is geographically biased, the scale of settlement and landscape investment in the western steppe, at least, is significant. It suggests that the 'gap' in settlement, preceding this development is likely a gap in our knowledge and a lack of recognition of low-level settlement and activity sites in existing surveys, coupled with limited investigation of certain environmental zones.

There are clear links between the Iron III ceramics of Gorgan and those of the Archaic Dehistan complex in the Misrian Plain. Yet, suggesting that this equated to a large-scale migration event would be stretching the evidence due to the limited chronological data available for this period from other sites on the Gorgan Plain. We should also be careful not to take the similarities in material culture between Gorgan and Dehistan to suggest a cultural uniformity or a centralised state system. Instead, we may be able to recognise similarities in socio-economic systems, particularly for semi-arid environments where we can draw parallels not only between ceramics, but also in settlement morphologies and the relatively rapid establishment of settlement systems in marginal regions. These socio-economic systems could perhaps be better understood through more detailed regional and inter-regional ceramic analyses that would allow us to recognize whether similar pottery was being produced at many different sites, or whether it was being produced and distributed from only a handful of large-scale production centres.

Overall, the resurgence of sedentary settlements across the plain at least by the Iron III period is under-explained. North of the modern Gorgan River, the landscape becomes incrementally drier due to decreasing rainfall (Kehl 2009 p.2; Khormali and Kehl 2011 p.111). While some occupation of the more northern arid steppes seems to have occurred in earlier periods, it appears to have been on a smaller scale. A shift to locally moister environmental conditions transpires c. 2.8 ka (that is c. 9th century BC) and may have played a role in making the steppe environments to the north of the River more attractive for settlement (Shumilovskikh et al. 2016 p.13). However, environmental change on its own is not a satisfactory explanation. What role did the arrival of the later territorial empires play in these events?

6.4.1 THE HISTORICAL NARRATIVE

Sauer et al. (2013 p.420) have already discussed the textual evidence for a Median presence on the plain, and the doubtful nature of some of these accounts; few conclusions could be drawn by way of comparison to the archaeological evidence from Qelich Qoineq (GWS_16) other than the fact that the date range of the site could overlap with the events mentioned. Western Iranian or Median presence at Tureng Tappeh was proposed to account for some of the ceramic forms in period IV (particularly IV B) at Tureng Tappeh (Deshayes 1969; Deshayes 1979), but these comparisons were made on selective grounds, and have been criticized for equating pots with people (Cleuziou 1986). For the Achaemenid period, more sources appear to exist and Christensen (1993 p.132–133) has stated that "…judging from the classical sources, we can assume that southern Gurgan, i.e. the area around the Gurgan-rud, formed even in Achaemenid times one of the larger areas of settlement of the Plateau". Attempts to link the archaeology of the Gorgan Plain and Dehistan to specific historical accounts have been made, particularly in relation to irrigation systems (these are in many cases much more durable features in the archaeological record than those representing pastoral practices). Sauer et al. (2013 p.420) citing a passage in Herodotus in which the Achaemenids began regulating water resources into a vast region where peoples such as the Hyrcanians lived, suggested that this description while likely exaggerating aspects, confusing details and perhaps conflating events and locations, might in some part refer to water management systems on the Gorgan Plain, and perhaps other similar regions. Lecomte (2009 p.74) draws on the same passage to suggest Achaemenid control of the head of the irrigation network that supplied water via the Atrak to Dehistan, though only changes in brick morphology in the sequence at Geoktchik Tappeh may suggest Achaemenid influence. Clearly, this account can be interpreted in a number of ways, and is so wide-ranging as to be of limited use.

Of course, this grand narrative also lacks a lot of information regarding subsistence strategies of local communities and what part pastoral practices played in the economic system. Clearly, the presence of hollow ways (which will be discussed in more detail below) speak to a significant pastoral component (likely daily movement of animals to pasture lands) in the strategies of communities living at sites in the dry farmed eastern steppe at some point between the Late Iron Age and Parthian periods.

Furthermore, numerous groups identified as nomadic in historical sources from the 1st millennium BC onwards including the Daians, Mardians, Derbikes, Cadusians, Tapyrians, and Apasiacans may have inhabited regions around the Caspian Sea (Potts 2014 p.89–118). These are often cast in opposition to sedentary communities and empires, and as such understanding to what degree nomadic groups integrated or interacted with, and influenced the settled communities on the plain, and the settlement patterns discussed above is difficult based on textual sources.

There are many holes in this narrative and marrying the archaeological evidence to the textual sources is fraught with problems. While we can begin talk about large-scale socio-political structures and empires, the data may be better suited to discussing how local communities were exploiting different environmental zones and adapting subsistence and economic strategies to these areas.

6.4.2 THE ARCHAEOLOGICAL DATA - SETTLEMENT ORGANISATION AND LAND USE

The archaeological evidence, while incomplete, suggests a considerable density of settlement across the plain from the late Iron Age through the Parthian period. Personal observation based on more recent survey work on the plain, suggests that Iron III ceramics are frequently found on sites, not only in the steppe margins, but across the southern part of the plain suggesting a significant increase in site number, and population in this period[26]. However, the fact that the majority of sites in both the western steppe margins and the eastern dry farming zones surveyed by the *GWS* had ceramics that appear to date to the Iron IV period suggests that the apex of the increase and expansion of settlement may have occurred following the Iron III period (or at least after the period Qelich Qoineq (GWS_16) was abandoned). It is still not clear however, if this occurred prior to, or perhaps during, a period in which the plain was under an imperial authority (See Table 6-1 to 6-3). If it began earlier, it may be that the existing settlement infrastructure and productivity that developed from at least the Iron III period may have made the plain an attractive prospect for imperial powers, such as the Achaemenids. However, only further detailed ceramic analysis accompanied by a program of absolute dating can clarify this. The rises and falls indicated between the Iron III/IV and Parthian periods in the Abbasi (2011 Maps 10-12) dataset may reflect issues in the recognition of certain ceramic types, but this data does seem to support considerable site density across the plain. Furthermore, the widespread distribution of ceramics associated with the Parthian period across the plain, likely also

[26] This data is currently being processed and will be published in conjunction with our Iranian colleagues in the near future.

reflects a continued high density of occupation (Wilkinson et al. 2013 p.102–144; Kiani 1982b p.39–61).

Of course, as several scholars have warned (Glatz and Matthews 2005 p.59; Schreiber 2001; Smith and Montiel 2001), there is a danger in equating changes in the ceramics sequence with political change, or using change in the ceramics as a marker of imperial influence. Trying to fit changes in material culture to a historical narrative is notable in several interpretations of settlement development on the plain (see Deshayes 1969; Vogelsang 1992 p.294–298). In doing this, the strength of local tradition in the face of imperial domination is masked, and the various ways in which material culture can reflect the amalgamation, adaptation or subversion of such traditions are ignored (Khatchadourian 2013; 2014; Ristvet et al. 2012). Indeed, in some cases, the near complete lack of change in material culture, despite historical narratives suggesting significant cultural or political change (see Lecomte 2009 p.74 for a discussion of this in regard to the Hellenistic and Parthian periods in Dehistan) suggest how difficult such a task may be. In reality, defining how the ceramics classifications such as Iron III, IV, and Achaemenid fit chronologically within the long-term narrative of empires in this region requires further study. However, the evidence suggests that the occupation of Qelich Qoineq (GWS_16) is linked to a wider regional socio-economic phenomenon that might predate the incorporation of the Gorgan Plain into an imperial realm. Furthermore, the preliminary ceramic studies of the *GWS* seem to suggest a gradual transition from the Iron III to IV periods with the apparent longevity of certain forms and the introduction of others that may signal socio-political changes. However, the introduction of new forms in the ceramic sequence at Tureng Tappeh following period IVA, which have not been identified in the regional ceramic sequence by the *GWS* (though this could be, at least in part, due to a lack of recognition) may tell a somewhat different story. This can only be understood by the restudy and publication of the materials from the Iron Age phases of Tureng Tappeh which are currently being undertaken (pers. comm Regis Vallet 2016). As such, we still have a long way to go in understanding the timing of the presence of external polities or empires on the plain in relation to settlement development in the Iron III and IV periods.

Supporting an increase in agricultural investment and population is the evidence from multi-proxy environmental data from the Kongor core on the eastern Gorgan Plain (Shumilovskikh et al. 2016). Increased cultivation of tree species is apparent from the

Achaemenid through Sasanian periods, with an increase in markers of anthropogenic influence on the environment from 2.7 ka, reaching a maximum between 2 and 0.76 ka. Furthermore, an increase in pastoral activity in evident in the multiproxy environmental data from at least 2 ka (Shumilovskikh et al. 2016). Data from pollen records in other parts of Iran, namely Lake Maharlou in southwest Iran, and the Lake Amalou area from northwest Iran, tells a similar story (Djamali et al. 2010 p.179–180). A core from the Lake Maharlou basin suggests that increased investment in the landscape in the form of cultivated tree species was occurring in the Achaemenid period concurrent with the construction of many water control features, not matched in either the Parthian or Sasanian period. Similarly, in the Lake Amalou Area an increase in cereal cultivation was noted in upland areas.

In the following sections (6.4.2.1 – 6.4.2.2), this overview of the regional trends will be broken down further with a consideration of the evidence for the use of the steppe sub-zones of the plain from the Iron III through the Parthian period. This will illustrate several distinct signature landscapes that vary geographically from east to west, but also at times overlap within the same subzone, highlighting the complexities of interpreting past settlement patterns and land use.

6.4.2.1 THE WESTERN STEPPE ZONE THROUGH TIME

We do not have a clear understanding of the length of the Iron III period and so determining the contemporaneity of individual sites is difficult. In the western steppe, GWS_3, GWS_15, Qelich Qoineq (GWS_16), and GWS_30 are located within a 10 km (east-west) by 8 km (north-south) area (GWS_5 is c. 12 km to the east of Qelich Qoineq), as is GWS_50 for which dating is uncertain, but the morphology is suggestive of a similar date. This concentration of sites, and in particular three sites of a similar, considerably large size c. 80 ha or greater (Qelich Qoineq (GWS_16), GWS_15, and GWS_50) is intriguing. However, we do not yet know the density of occupation at these sites, so size may be a misleading metric on its own. While GWS_3 and GWS_30 are of a magnitude smaller in size (c. 18 ha and 8-9 ha respectively), they are not clearly associated with one of the larger sites. Of course, occupation of these sites in the following period makes it difficult to ascertain site size by period for all but Qelich Qoineq (GWS_16) and GWS_30. Therefore, reconstructing a settlement hierarchy, if one existed, within this zone is difficult.

Ultimately, more detailed survey is required at the multiperiod sites to determine occupation area by period.

No evidence for dispersed settlements around or between sites such as Qelich Qoineq (GWS_16), or GWS_15 have currently been located in the field or on the imagery that might reflect rural satellite settlements of large urban centres like we see in Mesopotamia (Lawrence and Wilkinson 2015). Is this apparent lack of small satellite village sites representing a rural economic base problematic if we wish to characterise these generally contemporary large sites (e.g. Qelich Qoineq (GWS_16), GWS_5, GWS_15) in the western steppe as urban centres? Did such a base exist, but has not been recovered in the archaeological record? One would assume that even if only occupied for a few centuries isolated farmsteads, hamlets or villages may have survived as low tappehs (due to the degradation of mudbrick or chineh architecture), as in the low outer mounds surrounding Qelich Qoineq (GWS_16). This would seem likely as preservation is high in the landscapes to the north of the Gorgan River due to the lack of later intensive agricultural activities. Alternatively, the outer mounding around the qal'eh at Qelich Qoineq (GWS_16) may have originated as discrete farms or production areas; perhaps this evolved into a more traditional town-like site (however, if the occupants are not engaged in agricultural production, the problem of defining the economic base of the site would still exist).

As such, does this imply that the subsistence economy was run from these sites? Or, could it also suggest that a significant part of the subsistence strategy and economic infrastructure involved pastoralism? By way of comparison, a considerable number of Early Bronze Age sites in sub-optimal zones (where dry-farming is risky) of northern Mesopotamia "formed distinctly bounded and nucleated communities, surrounded by cultivated areas that, in general, lacked minor settlements in the immediate vicinity" and reflecting a specific socio-political system possibly involving a local ruler (Wilkinson et al. 2014 p.48). Their development appears to be linked to an agropastoral strategy suited to these zones (Wilkinson et al. 2014 p.96). Indeed, mixed subsistence strategies involving dry-farming and pastoralism are a proven way of dealing with the risk associated with cultivating in a marginal environment (Altaweel 2008 p. 112–113; Marfoe 1979; Wilkinson et al. 2014).

Returning specifically to the question of urbanism, what does this suggest? If we abandon traditional models of urban growth, and turn again to North Mesopotamia in the EBA, we can consider the suggestion that there existed multiple trajectories towards the development of towns and cities, as recognised by Lawrence & Wilkinson (2015). While much later than the Early Bronze Age examples discussed by those authors, Qelich Qoineq (GWS_16) does appear to fit their model of an exogenous upstart; characterised by rapid growth (over the course of a few centuries), and locations in environments not previously settled, and as such without pre-existing local populations upon which to draw (Lawrence and Wilkinson 2015 p.337).

The rather rapid growth of Qelich Qoineq (GWS_16) (even taking into consideration a more chronologically and spatially discontinuous development) is interesting. Where did the populations that inhabited this site come from? It is possible that shifts in settlement location and subsistence strategies may have resulted in the settlement of this and comparable sites in the western steppe. As such, the site could have developed from one of seasonal use to a more permanent settlement, but it does not indicate a region-wide contemporaneous process of sedentarisation. This would be too simplistic of an explanation. Furthermore, the similarities to the settlement types and material culture characteristic of the Misrian Plain during the Archaic Dehistan period is important, and suggests connectivity between the regions, and potentially similarities in socio-cultural or economic systems particularly in semi-arid environments. The Iron Age settlement of Dehistan appears to have begun much earlier than the occupation of Qelich Qoineq (GWS_16) (and potentially Tureng Tappeh (KH_123)), but this apparent chronological relationship does not suggest a large-scale migration event on its own. To do this would be stretching the evidence because of the limited chronological data for this period from other sites on the Gorgan Plain. Clearly, further data is needed to answer this question. A related, yet equally challenging question to answer is, what attracted significant numbers of people to settle, at least on a semi-permanent basis, in such sites in the western steppe margins? It seems likely, that while it is currently difficult to define the specifics, a set of opportunities arose at this particular time perhaps due to growing connectivity with other regions and resulted in increased economic opportunities.

But what can be said about the relationship between Iron III occupation and irrigation agriculture in this sub-zone? Did the growth of Late Iron Age settlement at sites like Qelich Qoineq (GWS_16), or GWS_15, for example, in the western steppe sub-zone involve, or more pointedly require, irrigation? Do the clear connections between the Iron III sites on the Gorgan plain and the Archaic Dehistan sites in Misrian suggest similar socio-economic strategies adapted to semi-arid environments? Does this strengthen the possibility that irrigation systems were in place in this subzone of the plain within the Iron III period? While the dense network of canals that have been mapped in the Misrian Plain likely reflect the final use of this system in the Islamic period (Genequand and Northedge 2014), initial construction of a number of these features have been attributed to the Archaic Dehistan period (Early Iron Age). This theory is based on the proximity of sites to canals, along with the supposition that irrigation would be necessary to sustain permanent settlement in this region (Lecomte 2009) (see Chapter 6.1). Furthermore, extensive irrigation systems appear as part of increasingly complex settlement systems in other parts of Central and South Asia in the 2nd and 1st millennium BC, such as in Bactria and Margiana (Kohl 1984 p.208; Lamberg-Karlovsky 2003) and the Bannu Basin in northwest Pakistan (Magee et al. 2005). These provide interesting parallels for indigenous systems prior to Achaemenid influence.

The relationship between Iron III occupation and irrigation systems (but not necessarily the North or South Canal in their final stages) is difficult to clarify with the current data, but one does seem plausible. If we consider the possibility that irrigation systems developed in this period, then the roughly equal spacing of the large sites with Iron III occupation in the western steppe might suggest that each site controlled the territory in its vicinity. This could again be likened to a Qala and Khan (Khanate) type socio-political system (see Lamberg-Karlovsky 2003 p. 14). The coordination of labour for the maintenance of water management systems may therefore have been achieved through means other than a centralized agrarian state model (Lecomte 2005; 2009; Negus Cleary 2013; Stride et al. 2009).

In section 6.2.1.2, I presented a possible reconstruction of the development of irrigation systems in the western steppe. While the timing of the proposed changes cannot be determined without further fieldwork, this model is suggestive of considerable adaptations to changes in the local environment (e.g. avulsions resulting in changes in the course of the Gorgan River due to natural events or human impacts) and social and political change. We cannot directly connect Qelich Qoineq (GWS_16) to either the North or South Canal. This may not be surprising as the the data does imply that these particular canals may be the final stages in the evolution of water systems within this subzone of the plain (that is likely Iron IV in date or later). However, traces of smaller canals and branch canals have been located on the imagery in relation to Qelich Qoineq (GWS_16) and other sites. Furthermore, the possibility of small-scale irrigation may also be found in the potential late Iron Age sites and associated canals off the stage 2b palaeochannel. As such, irrigation could have been in use prior to the construction of the North and South Canals. In fact, it is possible that the abandonment of Qelich Qoineq (GWS_16) was linked to changes in water supply. The survey data from other sites in the western steppe suggest that the entire zone was not abandoned when Qelich Qoineq (GWS_16) was abandoned. The location of the site at a distance from the main branches of the North and South Canal may be telling. As suggested above, the site could have relied on earlier irrigation systems and the North Canal could have usurped these systems. The decrease in pig in the faunal record of Trench P toward the end of the site's life may indicate that water resources were less available, but we must be cautious in assuming this based on one small sounding.

In the Western steppe average annual rainfall is between 250-300 mm, placing it on the cusp of areas which can be dry farmed without the aid of irrigation (Khormali and Kehl 2011; Van de Weg et al. 1968). Extensive, as opposed to intensive, cultivation as part of a mixed agropastoral strategy was practised by tribal Turkmen groups in the recent past. In the 19th century AD the *charwa*, or primarily pastoral segment of the Yomut and Goklan Turkmen, who traded much of their pastoral products with village communities to the south, would engage in some cultivation within the zone (De Bode 1848 p. 62–63; Marvin 1881 p. 52–54; Muraviev 1871 p.20; Yate 1900 p.217). The sub-zone continued to see low levels of cultivation into the mid-20th century AD, compared to the zone between the Alborz foothills and the north bank of the modern Gorgan River where more favourable conditions for agriculture existed and land use was estimated at between 70 and 100% cultivated. In the Late Iron Age, it seems possible that the Gorgan River was located farther north than its current course as indicated by Iron Age III/IV sites along the stage 2b palaeochannel. The location of the river is important as it could have provided more favourable conditions for cultivation in its vicinity, and could have extended the areas that could have been dry farmed, or irrigated via small scale irrigation systems from the river further to the north.

Therefore, the construction of the large-scale canal systems between the late Iron Age and the Parthian periods in this zone could be seen as an attempt to increase the northerly limits of cultivation in the western steppe. However, even with the aid of irrigation, it is likely that this zone would have been far less productive than the landscapes adjacent to the foothills of the Alborz Mountains. Indeed, cultivation in this environment would have been subject to increased risk from drought, a higher soil salinity (intensified by irrigation), shifting river courses that could have left irrigation systems without water and variations in the seasonal availability of water. For example, the amount of water flowing in the Gorgan River would have varied by season, with crossing the river much easier in the summer months (Le Strange 1905; Muraviev 1871); as such at this time of year, far less water would have been available for irrigation. However, waterlogged conditions in the excavated sequence at Qelich Qoineq (GWS_16) (Sauer et al. 2013 p.415) are evidence of the damp conditions that can prevail in the winter. The keeping of animals for example in the large empty space surrounding the qal'eh at Qelich Qoineq (GWS_16) may not have been feasible in the winter due to standing water, and may suggest the seasonal movement of animals along with parts of the community. Together this may further support the idea of mixed agropastoral strategies that involved a changing emphasis on herding and cultivation, through time, and perhaps in a seasonal cycle.

Further supporting a picture of a mixed subsistence strategy are the limited examples of radial hollow way systems located in the Western Steppe; these are few in number compared to the eastern dry farming zone (see below), but possible examples are found in association with Qelich Qoineq (GWS_16) and GWS_50, while the clearest examples are found at GWS_15 (see discussion below) (Figs. 6-37 and 6-38). Interestingly, these sites are the most similar in size and morphology. This suggests that the movement of herds, with relative frequency, was a part of the economy of these sites, as has been proposed in other areas of the Near East where hollow ways are a prominent feature (Casana 2013 p.270; Wilkinson 2003 p.559).

GWS_15, with occupation in the Iron III, IV and possibly Parthian period is also an interesting case study. The site appears to be considerably larger on the CORONA imagery than was documented in the field, as some of the outer mounds may have been destroyed by modern agricultural practices (Wilkinson et al. 2013 p.116). The extent of the outer mounding, along with the visible starting point of the hollow ways radiating out from the site, and the inner edge of the extensive relict field systems to the north of the site, suggests a site of similar size to Qelich Qoineq (GWS_16) (c. 85 ha). A considerable amount of empty space is visible around the central qal'eh and field observations suggest discrete mounds instead of continuous settlement beyond this. The hollow ways associated with GWS_15 are only visible to the south of the site, and are between 15 and 30 m wide and barring one, are between 0.5 and 1 km in length. One hollow way feature (HW_119) was over 2 km in length and may represent a longer-distance route, or may have led toward fields further removed from the settlement. The extent of these hollow ways may represent the limits of the area that could be dry farmed around the site, as demonstated in other contexts (Wilkinson 1993 p.559). The visible extent of field systems (but no hollow ways) up to c. nearly 10 km northwest of the site however, suggests a considerable area under cultivation, probably associated with irrigation. The lack of hollow ways to the north of the site may suggest that the northern field systems are later in date, and could have obliterated similar features. Wilkinson (1993 p.559) noted that hollow ways have lower chances of survival in areas in which settlement continued over a lengthy period of time and fields were constantly divided for inheritance purposes. As such we may be seeing changing agricultural and pastoral strategies though time, as the hollow ways and the field systems need not be contemporary. Additionally, the North Canal may cut the longest hollow way radiating out from the site, but the relationship between these features is not entirely clear (Fig. 6-38). This example hints at the possibility that this site, and the others in the western steppe with possible hollow ways (i.e. GWS-50 and Qelich Qoineq (GWS_16)) may have been established prior to large-scale irrigation systems in the steppe. As such, GWS-15 may not have relied on irrigation for (likely the earlier) part of its occupation. Furthermore, the field systems northeast of the site may not all be contemporary or associated with GWS_15 alone. The fact that at least, immediately north of GWS_15, the fields were most likely watered by the North Canal suggests use prior to the building of the South Canal. Clearly much more work needs to be done to unpack the complex landscape palimpsest around this and many of the sites in the western steppe.

Even so, in the western steppe, it is possible that within the broad time frame under discussion (Late Iron Age through Parthian period) we can unpack a number of overlapping landscape signatures. The most recent is characterised by large-scale canal systems, likely accompanied by extensive field systems. It is likely that these features were contemporary with settlement in this steppe sometime in the Iron III, but perhaps more likely in the Iron IV or Parthian period. Traces of an earlier landscape signature involving hollow ways, and potentially smaller-scale irrigation, is hinted at in particular locations in the zone, such as around GWS-15 or Qelich Qoineq (GWS_16)and speaks to evolving land use in this zone (Fig. 6-37 and 6-38).

6.4.2.2 THE CENTRAL STEPPE AND THE EASTERN DRY-FARMING ZONE THROUGH TIME

In contrast to the western steppe, no canal systems have been located to the north of the Gorgan River in the central or eastern subzones. Little can be said in terms of settlement or subsistence strategies in the periods in question in the central steppe. Along with several sites in the western steppe and the eastern dry farming zone, sites identified in the *GWS* in this sub-zone generally appeared to share affinities with the assemblage from Qelich Qoineq (GWS_16), but could represent an earlier Iron Age or Bronze Age horizon. This includes GWS_6 and GWS_8 in the central steppe, GWS_9, GWS_12, and GWS_14 in the western steppe and GWS_24 in the eastern dry farming sub-zone (See Table 6-3). Further evaluation of the ceramic assemblages of these sites is therefore needed. No clear pattern in site morphology is visible, some consisted of single mounds (e.g. GWS_12) while others appeared to have a main mound and outer mounding (e.g. GWS_6 and GWS-8). GWS_24, in particular, as it has radiating hollow ways similar to many of the other sites in the eastern dry farming zone, is worth further research. This may help us better understand the chronological development of ceramics in the Iron Age, particular settlement forms, and subsistence practices.

In the central steppe zone, the lack of reliable dating evidence for many of the sites makes it difficult to comment on settlement organisation, or even pinpoint a period in which the sub-zone experience maximum settlement density. The proximity (within a c. 2 km area) of at least one large (GWS_6) site, with several smaller ones (GWS_7 and GWS_8) may be significant, but there is far too little data to make any assumptions. Furthermore, possible new sites located in this zone have been identified with varying degrees of certainty, and are almost entirely without any ground control (see Table 6-11).

Occupation in the Iron III period can be found at only a handful of sites in the eastern dry farming zone, though this could be partly a factor of site sampling. In the eastern grouping, both GWS_26 and GWS_27 have ceramic assemblages that parallel Qelich Qoineq (GWS_16); interestingly, while both of these sites have some morphological similarities to Iron III sites in the western steppe, their boundaries are much more diffuse and they lack the area of empty space surrounding the qal'eh. Again, this comparison is complicated by occupation in the subsequent Iron IV-Parthian periods. Interestingly, at GWS-26, the upper qal'eh had both Iron III and IV occupation, but the lower qal'eh and outer town appear to have been dominated by Iron IV ceramics (Wilkinson et al. 2013 p.119). This trend requires further investigation and may provide interesting insights into the development of settlement within and between these phases.

While less distinct patterns in site morphology exist for the sites that appear to have been first occupied in the Iron IV period, there appears to be a consistent combination of a prominent central qal'eh or tappeh surrounded by low outer mounding, minus of course, GWS_42. Barring, GWS_19, GWS_20 and GWS_21, (and GWS_42) site size ranges between c. 10 and 30 ha (see Table 6-4 and 6-5). As noted above, the larger site sizes of GWS_19, GWS_20 and GWS_21 are possibly related to Islamic period activity. Therefore, it is difficult to discuss any sort of site hierarchy in a specific period with confidence. Even so, we can offer a few speculations on settlement organisation. For example, a differentiation in site size that may signify some kind of hierarchical settlement system in the easternmost grouping of sites with hollow ways, involving GWS_26, GWS_27 and GWS_42, though without further survey and dating evidence this is only speculative. In the westernmost grouping of sites in the eastern dry farming zone with hollow ways, Islamic period occupation on the largest sites such as GWS_21 and GWS_19 makes it difficult to ascertain whether they functioned as towns or even cities. We currently do not have the evidence with which to determine site function. However, even if these relatively large sites were towns or cities, it would be difficult to characterise the smaller sites within this sub-zone as villages; their size would suggest they fit within a town or city categorisation. Removing the three largest sites (which may also have achieved their current size in the Islamic period) the remaining sites with hollow ways in this zone appear to range in size from c. 3 to c. 20 ha. We may, of course, be missing smaller village sites due to survey methodologies. For example, three sites have been identified in the eastern dry-farming zone with Iron III/IV or Achaemenid occupation according to the Abbasi (2011) maps that are not visible on the imagery. This suggests they may be low-relief sites. Interestingly they are not arrayed around the other sites, but located along the northern edge of the dry farming zone. Again, it may be that specific agropastoral strategies evolved in this sub-zone which do not reflect the traditional model of urban centres with a rural base in the immediate vicinity.

Sites with visible ramparts (GWS_20, GWS_21, GWS_23, GWS_25 and GWS_41) cannot be correlated to specific sub-period of this broad time slice. Clearly the events that precipitated the building of an enclosure wall at Qelich Qoineq (GWS_16)were not the same ones that caused ramparts to be constructed at GWS_25. These sites are clearly chronologically separated. Equally, ramparts at GWS_21 for example may have been constructed in the Islamic period. Even so while the specific events that precipitated the walling of these sites may have been different, similar conditions such as the need to protect agricultural commodities or herds may have been present. Whether this was related to raiding by one of the many groups characterized as 'nomadic' living within the regions to the east of the Caspian Sea by this time, or another factor is difficult to say.

Hollow way formation appears to have occurred in several different phases in the eastern dry-farming sub-zone of the plain – the ceramic evidence suggests that these periods may correspond to a very broad Late Iron Age (likely Iron IV?) through Parthian horizon, and possibly the (Middle) Islamic period. Some of the wider darker hollow ways are clearly earlier than some of the slightly narrower, lighter edged ones that appear to be more common on sites with known or likely Middle Islamic occupation, but many examples cannot be so clearly attributed to one phase or another. Sites like GWS_18 though, that do not appear to have any occupation post-dating the Iron IV or Parthian period, do exhibit the characteristic dark, broad radial hollow ways.

The differences in hollow way morphology, and connectivity, discussed above, may therefore speak to differences in function and in the subsistence strategies of associated settlements through time. The somewhat broader, darker, radial hollow ways, narrowing toward their terminus, suggest the movement of herds out to pastures beyond cultivated areas and stability in settlement location and field boundaries. This has been suggested for hollow ways in other parts of the Near East, particularly Northern Mesopotamia (Casana 2013 p. 7, 12; Wilkinson 1993 p.559). While determining the importance of pastoralism to the economy of this settlement system may be difficult, it is argued elsewhere that broad hollow ways are indicative of specific pastoral practices (Casana 2013 p.14). Wider and deeper radial hollow ways, in other contexts, have been interpreted as suggesting frequent use, due to the fact that they likely carry more traffic on a daily basis than long distance routes (Wilkinson 1993 p.558). This may suggest a form of village based herding.

This sub-zone of the plain, with access to different resource areas and environmental zones is particularly suited to supporting an agro-pastoral strategy. Bounded as it is by hills to the north, and the Gorgan River to the south, this roughly 40 km long southwest by northeast corridor is only c. 10-12 km wide. Modern rainfall is high enough (c. 400-500 mm per annum) to practice dry farming. All of the sites located in this sub-zone (in multiple surveys and on remote sensing) sit within the mid-20th century AD land use zone utilized predominantly for the dry farming of wheat, or at the interface between this zone and one in which some dry farming of wheat was still undertaken, but grazing appears to be more predominant (see Van de Weg et al. 1968). The location of the interface between these two zones may reflect the modern sociopolitical situation more so than the capacity of the land for cultivation, but still speak to potential land use. The visible extent of the hollow ways associated with these sites are clearly dictated on the northern side by these hills. The hills are characterized as bare, with sparse steppic vegetation, and have been used for seasonal grazing from at least the early 20th century AD and continue to function as rangeland today (Irons 1974 p.638; Saadat et al. 2011 p.615, Fig. 3; Van de Weg et al. 1968).

The presence of these hollow ways suggests movement up into the hills from sites such as GWS_19, GWS_20, GWS_21 and GWS_44. The age of some of these hollow ways in particular are difficult to discern, but they do appear to be of the wider, darker variety. At least two (HW_39 and HW_32) appear to be cut by some of the narrower, lighter hollow ways (HW_137 and HW_138) extending from GWS_20 toward GWS_21).

These hollow ways could also be used as a proxy for determining the cultivated areas around sites. Again, however, we run into the problem of being unable to differentiate site area by period. Yet, at GWS_18 for example, which was occupied in the Iron Age IV period according to the *GWS* (and does not appear to have been occupied subsequent to the Parthian period in any other dataset – see Table 6 -1 to 6-3), the hollow ways clearly visible around the site suggest a sustaining area of c. 157 ha (see Wilkinson 1994 for an explanation of the relationship between hollow ways and sustaining areas). This area would not support a particularly large population within the 15 ha site, perhaps suggesting that the production of surplus of agricultural products was not of primary concern. The considerably longer hollow ways associated with GWS_19, GWS_20, GWS_21 and GWS_44 suggest substantially larger sustaining areas around these sites, but multiple phases of occupation and hollow formation makes it difficult to associate with a particular period.

However, it is possible that some of the significantly longer and narrower hollow ways may be more representative of site connectivity in the Islamic period than with sustaining areas.

In contrast to the western steppe, the eastern steppe appears to have a longer history of continued settlement, likely due to environmental conditions that make dry-farming possible, that is, at least 400 to 500 mm of rain per annum, and almost no soil salinity (Van de Weg et al. 1968). In a previous publication, the project speculated that the variation in site morphology seen in sites located in the northern subzones of the plain may be the result of these sites being occupied at different points within the Iron III, IV (Achaemenid?) and Parthian periods (Wilkinson et al. 2013 p.47). The reuse of some of these sites in the Islamic period (i.e. GWS_19 and GWS-20) may also have affected the morphology that we now see. It also further complicates our ability to make clear associations between site morphology and a more refined period of occupation. It should also be added that variations in site morphology and associated landscape features appear to also be linked to the environmental sub-zones of the plain (i.e. the semi-arid steppe to the north of the Gorgan River in the western plain vs. the wetter dry-farmed zone to the north of the river in the eastern plain) in which they are located.

Hollow ways are a much more prominent feature in this landscape (the eastern dry-farming zone) than in the western steppe, a difference worthy of discussion. Is this the result of preservation or does it reflect geographical variations in agropastoral strategies? While hollow ways do seem to frequently characterize dry-farmed landscapes such as in Northern Mesopotamia, they have also been observed in what might have been considered less optimal environments for hollow way formation. The correlation between semi-arid zones and hollow ways may have the most to do with the types of subsistence strategies being practised in these regions (Casana 2013 p.14; Wilkinson 1993 p.559). As such, the sites located in the eastern dry-farming zone appear to have been engaged in specific pastoral practices involving the moving of substantial herds with frequency beyond the limits of enclosed field systems. The lack of irrigation systems, and the size of the sustaining areas around particular sites (i.e. GWS_18), in the eastern dry-farming zone, might reinforce the notion of a subsistence strategy involving non-intensive agriculture, and limited production of surplus. In a modern example, rural communities, where subsistence farming can be uncertain, demonstrate shifts toward the keeping of herd animals as a way of diversifying the economy; as such environments where agricultural production is riskier often have larger herd sizes (Marfoe 1979 p.7).

While likely representing a strategy involving a wider range of mobility, a modern example of mixed land use strategies in this sub-zone of the plain can be found in the accounts of 19th century AD travellers. Yate (1900 p. 247–248) for example, noted that the charwa of the *Igdar* and *Kanyukhmaz* sections of the Goklan moved from south of the Gorgan River, to the Gokcha Dagh (Gokcha Hills), stopping to sow crops on the way; they then returned to harvest the crops in spring/summer, only to bury the grain and return to the Gokcha Dagh. They then moved back to the south of the Gorgan River, via their stored grain, in the late autumn. OF course, this is only one strategy and clearly reflects modern socio-political conditions. However, it speaks to land use potentialities, and helps us to build a picture of pastoral strategies, and multi-resource economies in their local and regional context over the long term emphasising the variability in strategies, an approach that has been advocated for in recent scholarship (Frachetti 2008b). It also speaks to how mobility can be an important part of the economy and helps to move away from focusing only on traditional village-based, land-focused attitudes of farming communities.

In summary, it could be argued that similar, yet subtley different, overlapping landscape signatures are visible in the eastern dry-farming zone. Settlements, and the likely formation of hollow way systems, of two different chronological horizons, namely the Late Iron Age through Parthian period and (possibly Middle) Islamic period, suggest land use strategies involving the frequent movement of people and animals beyond the boundaries of cultivation. More recent land use has done little to obliterate these signatures, suggesting that settlement and activity in this area in the following periods did not involve intensive cultivation.

6.4.3 LATE IRON AGE SETTLEMENT SYSTEMS: LOCAL RESPONSES OR IMPERIAL IMPACT?

The dating evidence from Qelich Qoineq (GWS_16) leaves room for its development to have occurred earlier than, or contemporaneous with, historical events involving either the Median polity or the Achaemenid Empire. In any event, a strong centralized authority could have directed settlement expansion into the steppe; this argument was favoured by Sauer et al. (2013 p.420) particularly because of the suggestion that its occupation may have been associated with the North or South Canal. However, our fragmented understanding of contemporaneous settlement, even within the Iron III period, and our poor understanding of the relationship between these canals and this site makes this difficult to verify.

Links between the ceramics of Iron III period Gorgan and Dehistan suggest complex and long-lived local and regional networks. While we have to be careful not to equate ceramic change (or lack thereof) with political changes, the irrigation systems of the Misrain Plain (if datable in their earliest form to the Iron Age) perhaps set a precedent for the development of similar small-scale systems in the Gorgan Plain without external involvement or top down imposition. Sustainability and stability of locally-managed water systems is often much higher than for systems imposed by centralized states; the latter lose the ability to respond to local conditions, and by becoming enmeshed in wider political and economic networks, are more affected by distant events (Mabry 1996 p.19). Broadening the scope, the emergence of complex socio-political systems in Bactria and Margiana in the Bronze and Early Iron Age, provide interesting models for the development of urbanism and complex irrigation networks (Kohl 1984; Lamberg-Karlovsky 2003). Similarly, in the Bannu and Peshawar regions of northwest Pakistan, the growth of regionally distinct polities, centralized systems, and irrigation networks developed in the early 1st millennium BC prior to the region being incorporated into the Achaemenid sphere (Magee et al. 2005; Petrie and Magee 2013).

The construction of large-scale irrigation systems in steppe regions (in this case, the North and South Canals in their final stages) suggests that there was an increasing population – the demand for food for urban centres, populations in the food-producing areas, and those required for the maintenance of irrigation systems themselves (Wilkinson et al. 2015 p.410). Perhaps corroborating this is the fact that from ~2.6 ka BP (c. 600 BC) there is an increase in cerealia-type indicators in the pollen record from the Kongor core located in the eastern and of the plain (Shumilovskikh et al. 2016 p.13). Our limited understanding of how settlement organisation changed between the Iron III and the Parthian period to the south of the Gorgan River hampers a fuller analysis, but the identification of Iron IV ceramics on a significant number of sites is noteworthy (Priestman 2013 p.524). Along with the considerable number of sites attributed to the Iron III/IV, Achaemenid and Parthian period in the Abbasi (2011 Maps 10-12) dataset, it suggests that a peak in settlement density may have occurred following the Iron III period (i.e. Iron IV which could include the Achaemenid, Seleucid or Early Parthian periods).

This would correlate with the period in which it seems likely that the irrigation systems in the western steppe may have been at their greatest extent. Indeed, there is more convincing evidence for the association of Iron IV sites with the use of the North and South Canal (e.g. GWS_5, and GWS_15 with the North Canal) than for Qelich Qoineq (GWS_16) (Chapter 6.2.1.2). The eventual abandonment of irrigation systems in this sub-zone of the plain could have resulted from further changes in the hydrology of the region or as has been noted in other areas, political instabilities that may have led to the silting up of the canals (Wilkinson et al. 2015 p.411). Furthermore, the data currently seem to imply that at least one period of hollow way formation in the eastern dry farming zone may have occurred in the Iron IV (post Qelich Qoineq through to the Parthian or even Early Sasanian period). This again appears to support increasing investment in the steppe margins in the Iron IV period.

So while we have historical evidence for periods of empire, do we actually see the physical traces of empire in the archaeological record? As we are dealing with a fragmented dataset, it is difficult to say. Clearly, the North or South canal coupled with an increase in population across the plain may represent imperial influence or subjugation. However it would be a stretch to infer that the population increase resulted from the settlement of populations from forced deportations, a feature of, in particular, Neo-Assyrian imperial landscapes (Glatz 2009 p.134; Parker 2002; Schreiber 2001 p. 71–74; Smith and Montiel 2001 p. 247–250). Equally, it could indicate state-level, but not imperial level, influence. As such, depending on the kind of socio-political organisation (see chapter 6.3.2 and 6.4.2.1), irrigation systems could have been state-run, or perhaps, as observed for other regions, "jointly managed systems administered by local associations in concert with government agencies" (Mabry 1996 p.11).

Furthermore, we lack the detailed ceramic studies, and absolute dates that would help us understand changes in material culture at the kind of temporal scales required to examine such change in the context of historical events, and what they may reflect. Overall, it is clear that the limitations of the data hamper the identification of short, and even medium term trends. Obviously, there is likely to have been considerable change over the course of the millennium or so between the settlement of sites like Qelich Qoineq (GWS_16) and the

Parthian period. Unfortunately, our poor understanding of the chronology prevents more fine-grained interpretations – in particular the long Iron IV period and the implications of defining chronological periods by empire.

What does the data from neighbouring regions tell us about the relationship between settlement patterns and political developments in the same periods? Similar expansions into marginal, previously uncultivated zones, along with investment in irrigation, can be observed between the Iron Age and the Parthian period in nearby areas. Unfortunately, a lack of radiocarbon dates for many of these regions, and the variations in ceramic chronologies can make it difficult to directly compare events at all but a broad scale.

Venco-Ricciardi's (1980 p.60) survey of the upper Atrak Valley noted continuity in settlement location between the Iron Age and Achaemenid periods, but with the advent of the Achaemenid period also the establishment of new sites with different functions and in different environmental zones. A notable increase in settlement between the Achaemenid and Parthian periods, was also noted including the founding of sites in new locations; previously occupied sites were less frequently reused (Venco-Ricciardi 1980 p.60). Peaks in settlement and the expansion of settlement and cultivation to areas not previously exploited for agriculture were also noted in the Murghab Delta (Margiania) in the Achaemenid period; the role of water control is emphasized as key in this transformation (Cerasetti 2008 p.35). However, the available data suggests that in the Hellenistic period, the area around the Merv Oasis (Margiana) experienced a decrease in irrigated land and settlement area, though this may partly be the result of ceramic dating and identification issues (Mairs 2011: 34). In contrast, the Damghan Plain, on the south side of the Alborz, only appears to have been re-settled in the Parthian period after a considerable hiatus. Furthermore, the correlation between Parthian (and Sasanian sites) with river irrigated areas (as opposed to those supplied by qanats and wells) suggested little imperial interest in the extensification of agriculture (Trinkaus 1983 p. 126–127, 133–134).

The situation in Bactria provides another interesting, and somewhat different view on these processes. French surveys in the Ai Khanoum Plain in modern Afghanistan suggest that irrigation systems were an enduring part of the settlement system on the plain long prior periods into which it was incorporated into an imperial sphere (Hiebert 1999). Indeed, while there site of Ai Khanoum itself represents a major Hellenistic urban foundation (though perhaps with earlier origins), the survey of the surrounding hinterland shows continutity in canal locations from earlier periods, though perhaps with some evidence for instensification of settlement and land use (Hiebert 1999 p. 175; Mair 2011 p. 27).

As Wilkinson (2003 p.150) noted, "the development of similar patterns of settlement resulted in the evolution of different rural landscapes because the communities involved had to deal with different terrain and operate within a very different political economy. Moreover, these processes of settlement dispersal were not contemporaneous throughout the Fertile Crescent but rather were spread out over a thousand years". While he was discussing the evidence from other regions of the Near East, his observation is relevant to the comparison made here between the Gorgan Plain, the Upper Atrak Valley, Damghan Plain, Margiana and Bactria. Clearly, while it appears that the settlement dispersal and expansion are characteristic of several regions in northern Iran and southern Turkmenistan from at least the 1st millennium BC (if not earlier) these events appear to have manifested at different times and in different ways adapted to local conditions.

6.4.4 THE STEPPE AS A ZONE OF INTENSIVE INTERACTION

> "The steppes were not badlands but rather an ecological space created through the fluctuations of the boundaries between cultivated lands and wildlands – the ebb and flow of the steppe frontier. The steppe and the sown were tangled and interwoven" (Khazeni 2010 p.600).

We had previously speculated that when the steppe margins experienced a considerable increase in settlement and landscape investment at some point in the late Iron Age there appeared to be little evidence that any perceived or real boundary, divided the landscape between communities practicing primarily agriculture and those engaged in predominantly pastoral modes of subsistence (Wilkinson et al. 2013 p.93). It is possible that in the prehistoric period, and at least by the late Iron Age, the extent of sedentary or semi-sedentary settlement involving some degree of agriculture to the north of the Gorgan River appears to have been determined by proximity to water resources rather than by any kind of physical boundary. This is further reinforced by the existence of the Iron Age communities in Dehistan, perhaps exploiting a landscape not dissimilar to that of the western steppe of the Gorgan Plain, and the clear connections between the two implied by the similarities in the ceramic assemblages. As such, in this period at least, perhaps we should be discussing a landscape organisation that reflects strong local and regional networks; interactions between disparate sedentary or semi-sedentary settlement areas, or the transfer of ideas and technologies, could have been facilitated by mobility. Instead of functioning as a traditional urban centre, sites like Qelich Qoineq (GWS_16) could have been focal points for interaction between communities engaged in a range of subsistence strategies; such a model has been convincingly argued for the qala-type settlements of Khwarezm (Negus Cleary 2013). While the walling of Qelich Qoineq (GWS_16) could indicate conflicts between settled and nomadic communities, it could also have functioned to keep animals in, or enhance the prestige of the site. The lack of obvious walling at sites with contemporary occupation (i.e. GWS_15, GWS_30) at least requires us to suggest alternatives.

The presence of nomadic groups is attested in the historical sources for the regions to the east and south of the Caspian Sea from at least the Achaemenid period (Potts 2014 p. 88–118). These groups are generally cast in opposition to settled communities, or portrayed as barbaric (for example see Strabo 1917 XI.7.1-2). The apparent continuity in settlement in the steppe margins following the Iron III period, and the lack of evidence for any sort of militarised zone, however, suggests a more complex relationship between agricultural and pastoral communities. Particularly as the region was incorporated into wider sphere of the Persia Empires, what was this relationship and did it result in the development of a 'frontier zone'?

As previously discussed, there is little direct evidence for Median presence or control on the Gorgan Plain, though later textual sources have been interpreted as indicating attempts at Median expansion into the region, or to imply some sort of historical tie to Media (Dandamaev and Lukonin 1989 p. 60–61; Vogelsang 1992 p.192). The incorporation of the plain into the Achaemenid sphere is undeniable and the region is said to have been part of the empire by the mid-6th century BC. From the imperial Achaemenid perspective, Hyrcania formed a peripheral part of the empire. Did the notion of a political frontier therefore start to take root, even if such a notion did not exist in the minds of local communities? It is important to consider that there may have been a difference in how the significance of the region was understood from a local perspective, and from that of the (distant) imperial core.

Following the collapse of the Achaemenid Empire, the Gorgan Plain, or Hyrcania, fell under Seleucid and then Parthian control (alternating between the two from the mid to late 3rd century BC to the early 2nd century BC, after which it was firmly part of the Parthian Empire). The maintenance of administrative systems put in place in the Achaemenid period may have upheld the role of the region as peripheral in Seleucid times (Venetis 2012 p.155), though in some regions there does appear to have been significant changes in the settlement system (e.g. the founding of urban centres like at Ai Khanoum in Bactria (Mair 2001 p. 26-27)). However, the homeland of the Parthian empire, existing at it did in Central Asia, could indicate a different geographical and political perspective on what was considered the edges of empire. The Gorgan region would have been a particularly attractive resource region close to the Parthian heartland. Significantly, the Behistun inscription suggests a close relationship between Parthia and Hyrcania even in the Achaemenid period (Behistun Inscription, Old Persian, column III trans. Kent 1953 p. 124). While we can only speculate, it is possible that through time there were multiple perceptions of where and even whether a frontier existed depending upon the political perspective (e.g. local vs imperial).

Can the archaeological evidence help us better understand the role of the steppe margins in these periods? The continuation of settlement to the north of the Gorgan River between the Iron III and (at least) Parthian period suggests some degree of stability in the settlement system over the course of several hundred years. However, evidence for changes in connectivity between the Gorgan Plain and regions to the north can be suggested. The clear similarities in material culture that we see between the Archaic Dehistan phase in the Misrian Plain and the Iron III sites in the Gorgan Plain do not appear to continue, though again further survey and excavation are needed. While there may have been a hiatus in settlement in the Misrian Plain following the Archaic Dehistan period, it is also possible that the ceramic assemblage (if settlement continues) does not evolve in step with that of Gorgan (Lecomte 2007 p.301). This may suggest a strengthening of the networks between the Gorgan Plain and regions to the south perhaps as a result of the integration of the plain into wider social and political spheres facilitated by the expansion of the later territorial empires.

Taken together, the sites and landscape features associated with the Late Iron Age through Parthian periods in the northern subzones of the plain represent a signature landscape (Wilkinson 2003) associated with the expansion of settlement into more arid regions accompanied in some cases by significant investment in irrigation systems. Similar exploitations of steppe environments involving investment in irrigation networks appear to be an important development between the Late Bronze Age and Early Iron Age in nearby regions such as Margiana, Bactria, and of course Dehistan (Hiebert and Lamberg-Karlovsky 1992; Kohl 1984 p. 193-208; Lamberg-Karlovsky 2003). While the mechanisms behind such trends are not universal, these, and in particular the Late Iron Age through Parthian period landscape signature on the Gorgan Plain, are in stark contrast to the signature that appears to develop in the subsequent Sasanian period, and which will be discussed in detail in the next chapter.

7 LANDSCAPES OF THE SASANIAN PERIOD ON THE GORGAN PLAIN

7.1 THE GORGAN WALL AND THE SASANIAN LANDSCAPE

In comparison to contemporary western empires such as Rome and Byzantium, the Sasanian Empire has been understudied. Most scholarship has focused on the textual evidence with some reference to the archaeological material, though usually only to supplement the historical narrative (e.g. Brosius 2006; Daryaee 2009; Daryaee 2012; Howard-Johnston 2006; Pourshariati 2008). In terms of research themes, reviews of Sasanian archaeology clearly indicate that up until recently, focus has been primarily placed on art, monumental architecture and coinage, with most focussed on south west Iran and Mesopotamia where many of the more spectacular sites, and rock reliefs have been located and partially investigated (e.g. Huff 1986; Mousavi and Daryaee 2012). Little attention, with some notable exceptions (e.g. Adams 1965; Neely 1974; Wenke 1975) was placed on understanding regional settlement patterns in the Sasanian period. In recent years, focus has shifted to more detailed explorations of various regions of the Sasanian Empire. The techniques of landscape archaeology have been employed in several projects focussing on heartlands and frontiers, especially in Khuzestan (Moghaddam and Miri 2003; Moghaddam and Miri 2007) and the Mughan Steppe in northwest Iran (Alizadeh 2011; Alizadeh 2014a; Alizadeh and Ur 2007) and of course the Gorgan Plain (see section 1.3.5). These studies, complementing earlier work, have highlighted similar, yet regionally adapted, patterns of investment in fortification on the frontiers of the empire, and agriculture and irrigation. Equally, research on the ceramics of the Sasanian period have helped to define regional sequences in much greater detail than ever before (Kennet 2002; Kennet and Luft 2008; Priestman 2013; Puschnigg 2010). More detailed explorations of Sasanian cities, such as at Merv in Modern Turkmenistan, have also widened our understanding of Sasanian urbanism (Simpson 2001; Simpson 2008; Simpson 2014).

As discussed in the previous chapter our understanding of the impacts of the Achaemenid and Parthian Empires on the landscapes of the Gorgan Plain is not as well understood, but increasing (cf. Chapter 8.2). In contrast, recent research by the *GWP* and *PP* has increased our knowledge of Sasanian investment in the landscape immensely, particularly of defensive features such as the Gorgan Wall, numerous rectilinear fortified sites, and canals that broadly relate to events of the 5th and 6th centuries AD (Sauer et al. 2013; Wilkinson et al. 2013 p.100–102). The majority of these features are concentrated to the south of the Gorgan Wall in the subzones of the plain that have seen maximum settlement density and investment in agriculture throughout time (Abbasi 2011; Arne 1945; Shiomi 1976; 1978; Wilkinson et al. 2013). The survival of these features in this 'landscape of attrition' (Wilkinson 2003) speaks to their monumentality.

In comparison to our understanding of the military architecture of the wall itself, less is known about urban, rural, or mobile pastoral land use or settlement patterns contemporary with the wall, or changes in these systems throughout the course of the Sasanian period. Similar issues have been noted for regions across the empire. Payne (2014 p.9) in a recent article on the archaeology of the Sasanian Empire has, for instance, suggested that our understanding of both agriculture in regional contexts, and the functioning of urban centres and investment in rural production need to become foci for further study. Furthermore, comparisons of Sasanian settlement and land use patterns across northern Iran with the Gorgan Plain have been hampered by the incomplete publication of excavated sites. For example, the importance of the site of Tureng Tappeh (KH_123) in the period of the Persian Empires is often overemphasized as it remained, until recently, one of the only examples of an excavated site on the plain with a long sequence (see Howard-Johnston 2012 p.102; Christensen 1993). While our understanding is still incomplete, recent research has begun to change our understanding of the region in the Sasanian period. The aim of this chapter is to build on the picture of the Sasanian landscape presented in the recently published monograph of the *Gorgan Wall Project* (see Sauer et al. 2013; Wilkinson et al. 2013) with further evidence gathered from the available settlement data and the remote sensing of satellite imagery. Can we begin to see changes in Sasanian strategies through time and how do these compare to earlier and later period land use and settlement? How did the Gorgan Plain's role as a frontier region affect these patterns? Accompanying these large-scale investments in defence, was the Sasanian Empire investing in agriculture on a significant scale? Or at the very least supporting local agricultural production? Can we see a similar level of investment in a network for the transport of people and goods within and beyond the empire?

7.2 THE DATASETS AND BROAD TRENDS

In chapter 5 I highlighted the broad trends apparent in the settlement data available for the Sasanian period in the Gorgan Plain. There are several issues that need to be borne in mind in order to assess the reliability of these patterns. Issues with site dating were discussed at a general level for each of the datasets in chapters 3 and 4, but it is important to reiterate these issues specifically in relation to our interpretation of the data for the Sasanian period. While we can place a high degree of confidence in sites assessed by the *GWS* as contemporary to occupation at Fort 4 (FORT_8), and Qal'eh Kharabeh (GWS_1), our comparatively poor understanding of the Early Sasanian and terminal Sasanian/Early Islamic ceramics will most likely have resulted in an underrepresentation of these phases in the settlement data. Furthermore, all of our well-dated mid- to late Sasanian ceramic assemblages come from what could be described as military or defensive contexts (i.e. forts, campaign bases). Furthermore, there is no published ceramic evidence for the Abbasi (2011) dataset, even though the author indicates that Sasanian period sites were assessed by comparison to, among other assemblages, those published in the preliminary reports of the *Gorgan Wall Project* (Nokandeh et al. 2006; Omrani Rekavandi et al. 2007; Omrani Rekavandi et al. 2008), suggesting some comparability. We must also view Kiani's (1982b) assessments critically, as it is now clear that he misattributed sites to the Parthian period that we now know to be Sasanian; however, he did correctly identify certain wares as Sasanian and, where illustrated, this information can help us to identify further Sasanian occupation. Overall, the observable 'Sasanian' settlement pattern may be the most representative of a mid to late Sasanian horizon, however, without further refinement of the chronology, we are generally limited to discussing trends in broad time slices. Fig. 7-1 presents all sites with a Sasanian component from multiple data sources; these are the *GWS* (Wilkinson et al. 2013), Kiani's (1982b) survey, the Iranian site visits (Abbasi 2011) and excavations (Boucharlat and Lecomte 1987). The reliability of the dating of these sites is presented as 'certain' (*GWS* laboratory assessment or published excavations), 'possible' (no or only partially published ceramics/only assessed by the *GWS* in the field, or given an uncertain Early Sasanian date by the *GWS* laboratory assessments, or identified as possibly Sasanian based on site morphology only), and uncertain (no evidence for Sasanian occupation noted in the *GWS* laboratory assessment, but a Sasanian date given in a field assessment or by another source with no published ceramic data).

Equally, survey coverage and methodology (see section 5.2.3) also affect our understanding of the Sasanian settlement pattern. For example, the *GWS* concentrated its efforts in the vicinity of the Gorgan Wall, and on large sites identifiable on the CORONA imagery. This has biased the *GWS* sample to particular geographical locations. Bearing these caveats in mind, however, several points of note stand out regarding site numbers and locations attributed to the Sasanian period:

- *Site numbers.* Site numbers, at least in the survey data available, appear to decrease significantly from the preceding periods (Late Iron Age through to the Parthian) to the Sasanian period (see Fig. 5-13). Following this, site numbers increase again considerably in the Islamic period. This is particularly evident in the Abbasi (2011) dataset. In the *GWS* dataset, while a much smaller and geographically selective sample, more sites were identified with an Iron III/IV or Parthian component than were identified with a Sasanian one (see Wilkinson et al. 2013 Table 3:5) but this may also be a consequence of the geographical coverage of the survey. The length of the archaeological periods involved, however, may also be affecting this trend. Depending on how the Iron III/IV period is defined, we could be looking at a period that covers up to 600 years, and masks many shorter peaks and troughs (see Table 4-1). This may affect the magnitude of change observed between the preceding periods and the Sasanian period. Furthermore, the significant increase in sites in the Islamic period (as compared to the Sasanian period) may also be magnified by the fact that there is no chronological breakdown of this lengthy phase, and the confidence in assigning an Islamic date to sites with glazed ceramics.
- *Site distribution.* Sasanian settlement appears to be focused to the south of the Gorgan Wall, with the exception of a handful of sites that will be discussed in detail. Furthermore, sites seem to be concentrated in the vicinity of the Gorgan Wall, or in the most fertile parts of the plain (i.e. those that are within c. 20 km of the Alborz foothills).

One of the goals of the current research is to see if these trends can be further interrogated with a critical review of the available survey data, and/or further explained with the addition of new data gleaned from the remote sensing of the CORONA imagery. For instance, do we see trends in the morphology of sites dated to the Sasanian period? Can we use our knowledge of well-dated Sasanian sites to identify potential new sites of similar morphological categories and expand our dataset? Moving beyond simple dot on maps, and taking into consideration factors such as site size, morphology and associated landscape features we can begin to construct a picture of the settlement, landscape investment (water control, routes etc.), and subsistence strategies practised in the plain during the Sasanian period. The dramatic and significant shift in settlement number and location that appears to characterise settlement system in this period is a fundamental part of a Sasanian signature landscape in this region. It is in stark contrast to the (multiple, complex and overlapping) signatures that characterised the earlier Iron Age through Parthian period in which the extension of settlement into the steppe was a key element. This Sasanian signature can be compared and contrasted not only with that of earlier periods, but also with that of the succeeding Islamic period, and with Sasanian settlement and land use patterns of other contemporary regions (see chapter 7.4.6 and 7.5). Finally, we can use this knowledge to generate more targeted research questions that can hopefully be answered with further fieldwork.

7.3 SASANIAN SITE TYPES IN THE *GWS* DATASET

As discussed in detail in chapter 3, a basic typology of site types based on morphology was developed during the *GWS* (Wilkinson et al. 2013 p.43–46) and was presented in Table 3-3 with modifications and additions to describe the main site types located in the field and on CORONA imagery. Several site morphologies, such as geometric fortified sites appear to have been an important morphological site type associated with the Sasanian period. This includes the forts lining the Gorgan Wall, which generally average between c. 1 and 8 ha (with an average of 3 ha) and the urban site of Dasht-e Qal'eh (GWS_54), enclosed within ramparts containing a dense patterning of internal features (see section 7.3.3).

More numerous, are the large geometric enclosures with few to no internal features (Fig. 7-2), which are typically located considerable distances to the south of the wall. These sites have been interpreted as Sasanian campaign bases (see below for further discussion) (see Sauer et al. 2013 Chapter 12). Qal'eh Kharabeh (GWS-1) can be considered the type site of this category; it was occupied in the early/mid-5th-mid-6th centuries AD, and appears to have been newly founded in a location without previous occupation (Priestman 2013 p.349–350). The site featured a corner citadel or qal'eh and measured c. 44 ha in size. Of comparable morphology, dimensions and dating is the site of Qal'eh Gug A (GWS-33) (c.

50 ha), though in this case an earlier tappeh was reused as the corner citadel of the ramparts. Sauer et al. 2013 (Table 12: 7) has also made an argument for Qal'eh-ye Pol Gonbad (GWS_37) (c. 126 ha), Qal'eh-ye Daland (GWS_53) (c. 53 ha), and Gabri Qal'eh (GWS_49) (c. 43 ha) also existing within this category. The ceramics from Gabri Qal'eh (GWS_49) appear to confirm Sasanian (and later Islamic) occupation, but surface finds were notably scarce at Qal'eh-ye Daland (GWS_53) and Qal'eh-ye Pol Gonbad (GWS_37), neither of which feature a corner citadel; this lack of a citadel might explain the dearth of surface finds, as occupation within the enclosure if by military forces may have been temporary (see Sauer et al. 2013 p.353). Recent excavations at Qal'eh Pol Gonbad (GWS_37) will hopefully provide absolute dates for its construction. Lastly, Qal'eh-ye Yasaqi (GWS-35) (c. 19 ha) was also suggested to represent another example of a campaign base, though perhaps for a smaller military force (Sauer et al. 2013 p.367); however, it may also have served other functions. The site clearly incorporates an earlier component (possibly the prominent mound/citadel) (see Kiani 1982b Fig. 49; Wilkinson et al. 2013 p.121), but ceramics contemporary to those found on the Gorgan Wall were also noted. Kiani (1982b p.70) also suggested occupation in the Parthian, Sasanian and Islamic periods; the pottery he illustrates from the site includes the legs of several tripod bowls in a grey fabric perhaps more characteristic of the Iron III or IV period.

Beyond this, however, our knowledge of site types confidently associated with occupation in the Sasanian period has been few and far between (Priestman 2013 Fig. 18:39). Several examples of small single qal'ehs or prominent mounds have been located (Fig. 7-3). Buraq Tappeh (GWS_2) (c. 1 ha), is a roughly small square qal'eh, occupied exclusively in the mid- to late Sasanian period (contemporary with the wall, Qal'eh Kharabeh (GWS_1) and Fort 4 (FORT_8)). Perhaps a small fortlet, it was protected on its north side by a meander of the Stage 3 palaeochannel of the Gorgan River; another site (GWS_13), consisting of low mounds, only a few hundred metres to its southeast appears to be associated (Wilkinson et al. 2013 p.113). A second well-dated example of this site type is Tureng Tappeh (KH_123), a prominent qal'eh-like mound with occupation dating back thousands of years; in the Sasanian and post-Sasanian period the site served as a fort, and later a fire temple (Boucharlat and Lecomte 1987). A further example, of this site type may be found in the site of Qal'eh-ye Qabrestan (GWS_56) also interpreted as a possible Sasanian fortlet or watchtower based on its morphology (Sauer et al. 2013 Fig. 12.2). It is located in the eastern half of the plain south of the Gorgan River, but within 4 km of the Gorgan Wall.

Interestingly, while no site description is provided, pottery from the site illustrated by Kiani (1982b p.64, Fig. 56) includes incised red wares that he attributes to the Sasanian period. This category has proven generally comparable to REDPLI in the Qal'eh Kharabeh (GWS_1) and Fort 4 (FORT_8) assemblages (Priestman 2013 p.528), though Kiani's illustrated examples from this particular site provide no exact parallels.

What is clear from these data, is that our understanding of fortifications and structures of a military nature completely dwarfs our knowledge of any other site type. A strong but not exclusive (the Islamic site of Agh Qala for example is contained within rectangular ramparts and measures at least 88 ha) association between large rectilinear enclosures with a minimum of internal features and Sasanian occupation seems apparent. Furthermore, data on Sasanian site types from neighbouring regions indicate a strong correlation between rectilinear fortified sites (of varying sizes and multiple functions) and Sasanian period occupation (Alizadeh 2011; Trinkaus 1983; Venco-Ricciardi 1980). To further explore this association, the database was queried so as to produce a list of all sites with known Sasanian site types (geometric/rectilinear enclosures, rectilinear qal'ehs etc.); this included site morphology observed on the CORONA imagery or described by various surveys as rectilinear, rectangular, square, or geometric in combination with site feature such as qal'ehs, ramparts, and enclosures. This produced further examples of rectilinear/geometric enclosures (of varying sizes) and rectilinear qal'ehs, either on their own or as part of larger site complexes (see Table 7-1 and Table 7-2). These sites were then cross-referenced with dating information (if available) and evaluated in terms of their location and associated features. Following this, all other sites identified as Sasanian in other survey datasets were evaluated to see if any common morphological characteristics, as well as similarities in location or associated landscape features could be observed (see Table 7-3). Were there any patterns in morphology associated with Sasanian occupation? This sample included only those that were visible on the CORONA imagery; that is, where an archaeological site visible on the imagery could be confidently associated with a surveyed site with attached dating information.

7.3.1 SITE MORPHOLOGIES ASSOCIATED WITH THE SASANIAN PERIOD

This section will discuss sites in the database with morphologies that have characteristics of Sasanian period sites identified by the *GWP* through excavation and survey – primarily sites with large geometric enclosures. However, other site types clearly existed, and these will be discussed in chapter 7.3.2. The exercise described above produced further examples of rectilinear/geometric enclosures. On the CORONA imagery, these were defined through their distinct signature of raised walls or ramparts around their exterior, in some cases with, but in most cases without internal features (Table 7-1, and Fig. 7-4 – Fig 7-6). These sites fall into several size classes – with the majority measuring less than 1 ha, several with areas of c. 2-6 ha, and a few examples of considerably larger enclosures. Interestingly, in all but a few cases, these sites were located to the south of the Gorgan Wall. Furthermore, none of the enclosures of any size without associated qal'ehs or mounds had been previously recorded. This is likely due to their lack of surface relief, suggesting that these sites are under-recognized in the survey record, particularly as no intensive survey has ever, to my knowledge, been conducted on the plain.

The largest rectangular enclosure (KH_84) was of significantly larger proportions (c. 77 ha) than any of the other examples, and was located approximately 4.5 km to the southwest of Qal'eh Daland (GWS_53) (Fig. 7-4). The site does not appear to have been recorded in any previous surveys. The site sits between two streams flowing down from the Alborz toward the Gorgan River. These channels (along with relict incarnations of them) have eroded out parts of both the east and west sides of the enclosure. On the east side a dark linear feature following the line of the enclosure on its outer edge may represent a ditch or moat that would have surrounded the site. Crenulations around the exterior of the enclosure are similar to those visible on the CORONA imagery for Qal'eh Gug A (GWS_33), and Qal'eh-ye Daland (GWS_53); in the case of the latter these were interpreted representing projecting towers (Sauer et al. 2013 p.324). Like Qal'eh-ye Daland (GWS_53), and also Qal'eh Pol Gonbad (GWS_37), it also appears to lack any internal features or a corner citadel. The shape of the site (rectangular rather than square) marks it out from the other examples listed above, and the size is larger than Qal'eh Daland (GWS_53), Qal'eh Kharabeh (GWS_1), Qal'eh Gug A (GWS_33) and Gabri Qal'eh (GWS_49), but still smaller than the proposed campaign base of Qal'eh Pol Gonbad (GWS_37). A prominent tappeh with possible low outer mounding sits c. 800m to the north of the site with components said to be occupied in the Bronze Age, Iron Age III/IV, Sasanian and Islamic periods (Abbasi 2011 Maps 7-10, 13-14). Without further on-the-ground investigations, little else can be said at this point regarding its date or function, though based on its morphological similarity to other such sites may suggest that it represents a further example of the "campaign base" site type.

Two other sites previously identified on the CORONA imagery and assigned *GWS* numbers, but not visited in the field (see Wilkinson et al. 2013 p.83–84), were also flagged up, and are worth mentioning as possible examples of this site type. GWS_55, an unnamed fortification to the south southeast of Gorgan Wall Fort 25 (FORT_29) measuring c. 62 ha, and KH_121 (GWS-62), a tappeh and complex of low mounds appearing to form one side of large geometric enclosure of 71 ha (see appendix). One further rectilinear enclosure (KH_39) was noted, not having been previously recorded by the GWS, at c. 15 ha in size, and appears to be part of a larger site complex, is rather indistinct and cannot be definitely confirmed without further fieldwork. There is no available dating information for the first example, while the associated mounds of the latter two were both suggested to have been occupied in multiple periods but with no mention of Sasanian occupation (Abbasi 2011).

A handful of rectilinear enclosures measured between 2 and 6 ha (Fig. 7-5). One site, TJW_3, was briefly visited by Tony Wilkinson and Hamid Omrani Rekavandi and noted as a possible fortlet. Its size (c. 5 ha) is not dissimilar to the many of the forts lining the Gorgan Wall, and its close proximity to the wall (c. 450m), and Fort 14 (FORT_17) and 14N (FORT_18), may suggest a relationship with one or the other of these features[27]. Another example within this size category is a c. 2 ha enclosure (KH_196) c. 800 m to the north northwest of the citadel at Gabri Qal'eh (GWS_49). Its proximity to the likely Sasanian campaign base may suggest a relationship (i.e. is it a forward lookout fortlet?), although Gabri Qal'eh (GWS_49) continued to have significant occupation until the Early Islamic period. KH_12, (c. 3 ha) perhaps resembling a rectilinear fortified mound with a square corner citadel, more than an enclosure, also fits within this category. These three sites are similar in size to several rectilinear enclosures (c. 6 ha or less) located near the Gorgan Wall or further south in the plain that Sauer et al. (2013 Fig. 12:2) suggested might have served as forts or fortlets during the Sasanian period. This includes a square enclosure (KH_5), and Qal'eh Hajilar (GWS_57) (See Fig. 7-5E, F). The former sits immediately south of the Gorgan River to the east of Gonbad-e Kabus, and c. 5 km south of the Gorgan Wall within a palimpsest of archaic field systems and other features of unknown date. The latter is located immediately south of the Gorgan River, and c. 2 km south of the Gorgan Wall. However, despite its proximity to the wall, Qal'eh Hajilar (GWS_57) differs slightly in

[27] Fort 14 N (FORT_18), may have been constructed in the Islamic period. Wilkinson et al. (2013: 131 note 228) indicates some Gorgan Wall and probably Islamic bricks, as well as middle Islamic pottery.

morphology in that “the distinct internal patterning of buildings and walls within the interior of the fort suggests that this may be a rather late, post-Gorgan wall structure” (Wilkinson et al. 2013 p.125). However, none of these features have available dating information, and it is possible that some of these small rectilinear enclosures may have represented occupation sites, such as fortified manors or farms, and not served a solely militaristic function. Sites of this type would have served to provide security in a frontier zone for growing local produce, for example, to supply military units.

Of the rectilinear enclosures that measured c. 1 ha or less in area, none had associated dating information (Table 7-1; Fig. 7-6). Unlike almost all other known rectilinear/geometric sites in the plain, several examples were located to the north of the Gorgan River and Wall. Of the first (KIA_13), little can be said regarding its function other than it sits nearly 3 km north of the wall and appears to be part of a larger site complex with no available survey information. The other two sites (KH_51, and KH_63), are located northwest of Gonbad-e Kabus at a distance of c. 20 and 30 km respectively. Their morphology and location along a main route north from Gonbad might explain their location in an area otherwise empty of archaeological features visible on the CORONA (see section 7.4.4 below). The northernmost, KH_63 is comprised of a series of three enclosures (of which the north western-most may represent a qal’eh) and may correlate to a site mentioned on Kiani’s (1982b Figs. 30-31) map as Qal’eh Kohneh (KIA_49), for which no further information is given in the text.

These sites are differentiated from those classed as rectilinear qal’ehs, another category explored as a potential site type of the Sasanian period, by subtle differences in morphology, namely that sites classed as qal’ehs tended to be fortified mounded sites, though with similar shape (generally square), and sometimes have associated extramural settlement (rare in the examples of the enclosures given above). However, depending on the signature on the imagery or the description of the site in the available survey data it is possible that there is overlap in these categories. Furthermore, as discussed in the previous chapter, rectilinear qal’ehs feature in several sites clearly datable to an earlier horizon (e.g. Qelich Qoineq (GWS_16) or GWS_15). A search of the database produced four examples with occupation indicated for the Sasanian period. All were located within c. 10 km of the Alborz foothills and all had either earlier or later occupation, making it difficult to confirm any link between this morphological category and date (Table 7-2).

7.3.2 MORPHOLOGY OF SITES ATTRIBUTED TO THE SASANIAN PERIOD IN OTHER DATASETS

The dating and morphology of sites possibly attributed to the Sasanian period to the north of the wall will be discussed separately in the following section (7.4). Thirty-six sites dated to the Sasanian period located to the south of the Gorgan Wall in other surveys (not discussed above) that were visible on the CORONA imagery are presented in Table 7-3, along with two *GWS* sites with possible early Sasanian occupation not yet discussed. All but one, have dating information which suggested that they were occupied in multiple periods (in some cases it was not possible to distinguish the area of Sasanian occupation within a larger site complex, so the dating evidence is considered for the larger site as a whole). Six sites have Sasanian and Islamic material only, 10 appear to have been occupied in earlier periods but not subsequently, while 19 have both earlier and later occupation. This is relevant as it will affect how we interpret any patterns in site morphology.

Overall, there are few patterns observable in the morphology of sites in this sample. Of the sites evaluated, morphologies ranged from circular, ovoid and rectilinear tappehs (with or without low outer mounds), to complex topographic mounds, complexes of low mounds, and rectilinear qal'ehs (sometimes with low outer mounds); this likely reflects the long history of settlement in the southern part of the plain with considerable re-occupation of sites through time. Without an understanding of site area by period, it is difficult to characterize the nature of Sasanian settlements on the plain[28]. The category with the most examples is that of small tappehs (circular/ovoid/ irregular) with the majority having visible extents either from the CORONA imagery or from field surveys (i.e. Shiomi 1976; 1978) of less than 1 ha. Identifying the extent of the largest site is difficult, due to the multiperiod nature of many sites, and difficulties in identifying low lying outer settlements on the CORONA imagery in landscapes (like those in the southern part of the plain) that have seen higher rates of destruction of archaeological sites due to the effects of irrigation agriculture. However, none of the examples in the limited sample presented here appear to exceed 20 ha.

[28] In some cases it appears that different periods of occupation may have been assigned by site area in the Abbasi (2011) dataset, but it is impossible to tell which areas correlate to which parts of the sites located on the imagery. As such the periodisations are taken for the site as a whole.

An important observation can be made however regarding Sasanian period site morphologies based on this data. Whereas, in for example the Mughan Steppe, Sasanian period sites generally consisted of fortified structures measuring between 30m x 30m and 100 m x 100m (with one large example at c. 28 ha) surrounded by extramural settlement (Alizadeh and Ur 2007 p.152), the ease of identifying this pattern is tied to the fact that these sites appear to be new Sasanian foundations. As such, the Sasanian period sites with distinctive morphologies (i.e. rectilinear enclosures/qal'ehs) on the Gorgan Plain, in many cases appear to have been occupied initially in the Sasanian period; furthermore, unlike in the Mughan steppe, there appears to have been very little mid to late Sasanian investment in marginal environments where preservation may be higher.

7.3.3 URBAN, RURAL AND MILITARY- SITE NUMBERS, SIZE AND FUNCTION

In the Abbasi (2011) data there is a clear and significant decrease in the number of sites attributed to the Sasanian period. Nearly five times as many sites were identified as having an Iron III/IV component, nearly two times as many with Achaemenid material, and approximately three times as many with Parthian material. The lack of an absolutely dated chronological sequence for the Iron IV through to Parthian periods has more than likely contributed to over-exaggerated peaks (the conflation of Iron III/IV sites), and possibly exaggerated lows (due to possible overlap in the interpretation of Iron IV and Achaemenid period ceramics). The possibility for the misattribution of Sasanian ceramics to earlier and later phases, or the overrepresentation of mid to late Sasanian material is also possible (see Chapter 7.2 above). However, even if the peak in settlement seen in the Late Iron Age-Parthian periods were muted, the decrease in site numbers in the Sasanian period is significant enough to suggest that it may not just a product of an incomplete settlement record. It is important to note that this is based mainly on the identification of tappeh-based settlement (prominent mounds) and may be significantly underrepresenting other settlement types (i.e. low-level relief sites). The increase in sites identified as Islamic to nearly three times that amount seen in the Sasanian period is also likely due to the conflation of significant number of sites dating to a long Islamic period that masks subtler peaks and troughs (Fig. 5-13). As such determining the exact magnitude of a diminution in site numbers in the Sasanian period is difficult.

If this decrease in site numbers is real, does it suggest a significant decrease in population? Site number, however, is a potentially misleading metric on its own. While site number may increase or decrease, it is more meaningful when presented in conjunction with site size. Ideally, the aggregate occupied area for each archaeological period could be compared to site numbers in order to establish whether or not decreases in site number corresponded to a decrease in aggregate occupied area (indicating an overall reduction in sedentary population) or increases in the aggregate occupied area that might suggest settlement agglomeration into larger centres (indicating a possible increase in population). Unfortunately, the available survey data provides limited information on occupied area by period, a problem when dealing with multi-period sites (as so many on the Gorgan Plain appear to be).

Despite this issue, comparing the number of sites, and a gross calculation of the aggregate occupied area[29], of all Late Iron Age-Parthian sites, to those of the Sasanian period provide interesting, if preliminary, insights (Table 7-4). If we assume the maximum possible aggregate occupied area for each horizon, then it would suggest that there was a decrease in site number and site area from the Late Iron Age-Parthian horizon, to the Sasanian period. However, the ratio of site number to aggregate occupied area does not differ dramatically. It must be kept in mind, though, that figure for the maximum aggregate occupied area for the Late Iron Age-Parthian horizon is exaggerated due to the length of the horizon. By how much, though, is uncertain[30]. On the other hand, if we use the minimum aggregate occupied area for the two horizons, there is little change between the two chornological periods despite there being over two and a half time more sites included in the calculation for the Late Iron Age-Parthian horizon. This would suggest a considerable increase in site size in the Sasanian period as compared to previous periods. In order to further flesh out this trend, an exploration of the site morphologies of the Sasanian period discussed in the previous sections (7.3.1 - 7.3.2), can help us to make some broad comparisons to site types and sizes of previous and later periods.

[29] This is from sites with associated site size data from survey or remote sensing

[30] The considerable difference between the minimum and maximum site sizes for the Iron Age through Parthian horizon is the consequence of several factors. Often, in older survey datasets (i.e. Arne 1945, Shiomi 1976 and 1978) only the main tappeh was recorded, however, inspection of the CORONA imagery has led to the detection of outer settlements beyond the main tappehs at numerous sites (though some of these need to be confirmed in the field). Despite this, the density of occupation within some of these larger settlements, is uncertain, as discussed in chapter 6.3.

7.3.3.1 SASANIAN TOWNS AND CITIES

Table 7-5 lists sites over 30 ha in size as recorded on the CORONA imagery or in field surveys along with dating information where available (Kiani 1982b; Shiomi 1976; 1978; Wilkinson et al. 2013). By far the largest site on the plain is that of Jurjan, a prosperous town in the Early and Middle Islamic period (see KH_138 in Appendix B). Notably, it may also be a candidate for the Sasanian capital of the same name, though no archaeological evidence currently exists to confirm this (see Sauer et al. 2013 p.360 for a discussion of this topic). The site of modern Gorgan (formerly Astarabad) was also a prosperous town in the Islamic period; Qal'eh Khandan (ARNE_148), and other archaeological features within the limits of the city appear to have been occupied for millennia, and may have also been part of a Sasanian town (Abbasi 2011; Kiani 1982b). The extent of the site in any period is difficult to determine due to the urban sprawl of the modern city.

Sasanian occupation, however, has been confirmed at the next largest site on the plain, Dasht Qal'eh (GWS_54) (c. 338 ha within the ramparts) (See Appendix B). The site is surrounded by ramparts and has a prominent mound in its southeast corner. Ceramics from the site indicate prehistoric, Sasanian and Early Islamic occupation, with the prehistoric occupation likely restricted to the mound and its vicinity (Priestman 2013 p.523); However, radiocarbon dates from contexts interpreted as signalling the construction of the ditch and ramparts suggest a date similar to the construction of the Gorgan Wall for the site in its urban form (Sauer et al. 2013 p.401–402). Clearly internal features are visible on the CORONA imagery suggesting that the interior of the site contained a dense arrangement of buildings. This appears to be confirmed by limited excavations by M.Y. Kiani (1982b p.49–52) and the *GWP* (Sauer et al. 2013 p.386–388) which indicate significant brick pillars and other structures. As such, based on the current evidence Dasht Qal'eh (GWS_54) may be a better candidate for the Sasanian capital of Jurjan. This site is nearly three times larger than the next largest site located on the plain, GWS_50, also a site with a probable Sasanian component, but with earlier occupation and a site morphology characteristic of Iron III through to Parthian period sites in the western steppe.

As discussed in chapter 6, our understanding of site types associated with the Late Iron Age through to Parthian periods is limited to particular environmental sub-zones of the plain, and by our understanding of the ceramic chronology. However, if we look at other sites attributed to the Iron III through to Parthian phases in the western steppe, both Qelich

Qoineq (GWS_16) and GWS_15 are c. 80 -87 ha in size. In the eastern dry farming zone, both GWS_19 and GWS_21, measuring c. 103 and 72 ha respectively were also likely founded in the Iron IV period (with possible (early?) Sasanian occupation); however, their sizes likely reflect the extent of the sites in the Islamic period. Regardless, it appears that the founding of Dasht Qal'eh (GWS_54) in its urban form signalled a massive increase in site size not seen in any prior period.

Equally, if we take Qelich Qoineq (GWS_16) as an example of site size and density characteristic of the Iron III period it has been demonstrated that while a site of considerable size (c. 80 - 87 ha), the density of settlement at the site at any one time is open to debate. Whether or not this type of settlement continued to be characteristic of sites in the western steppe into the Iron IV through to Parthian periods at sites such as GWS_15 is difficult to say, but the similarities in morphology observed on the CORONA imagery are suggestive. Of course it is difficult to comment on the morphology, size or density of occupation on sites of these periods in the southern part of the plain. However, it is notable that sites over 30 ha in size located to the south of the Gorgan River besides Dasht Qal'eh (GWS_54) and Jurjan (KH_138), are primarily large geometric fortified sites with few external features (likely dating to the Sasanian or Islamic periods) (see Table 7-5).

7.3.3.2 GEOMETRIC FORTIFIED SITES

The large geometric fortified sites with minimal internal features discussed above, are of course also of substantial size, but appear to lack features associated with urban sites, in particular, evidence for dense internal features. As such they have been interpreted as campaign bases suggesting a military function, and short-lived occupation (Sauer et al. 2013 Chapter 12). While several of these sites have prominent qal'ehs or citadels (i.e. Qal'eh Kharabeh (GWS_1) and Qal'eh Gug A (GWS_33) – incidentally ones with confirmed Sasanian occupation) that could have represented more permanent settlement, the minimal evidence for internal features within the enclosure does indeed suggest temporary, or at least special purpose occupation. The only exception may be Gabri Qal'eh (GWS_49), which appears to have evolved into an Islamic period settlement, however the extent of occupation within the enclosure during the Sasanian period is not currently known (Sauer pers. comm. 2016). However, geophysical survey can sometimes reveal features not visible on the satellite images. The geophysical survey at Qal'eh Kharabeh (GWS_1), for example, revealed rows of features within the interior of the site that likely represent rows of tents or other temporary structures (Sauer et al. 2013 p.312–313). While this reinforces the ephemeral nature of settlement at this site, it is possible that in other cases internal features are simply not detectable via remote sensing (possibly the result of taphonomic processes – e.g. the use of mudbrick as opposed to fired brick).

Widening the net for alternative interpretations of these structures, we could make comparisons to the kala sites characteristic of Khwarezm and the Margiana oasis discussed in chapter 6 – while generally smaller in size and wider ranging in date, the general lack of external features along with a single prominent qal'eh-like feature are indeed similar and may suggest similar functions (Hiebert 1994 p.21, Fig. 2.7; Negus Cleary 2007; 2013 p.94). Clearly not urban centres in any traditional sense, these qala sites have been convincingly argued to have perhaps served multiple functions for local oasis communities engaged in a range of subsistence activities (Negus Cleary 2013). Differences, however, are also apparent; none of the geometric fortifications in the Gorgan sample appear to have attracted any extramural settlement that can clearly be associated with the enclosures, perhaps reaffirming their temporary (military?) occupation. This of course assumes that the nature of any external settlement would have taken the form of permanent structures, something difficult to confirm or deny. Sauer et al. (2013 p.347) furthermore suggested that there was no indication of agricultural activities at or near the site (i.e. associated field systems, or agricultural implements in the excavated sequence), again perhaps suggesting short-term occupation. However, while this may tell us something about the types of activities that did or did not occur near the site, it should not necessarily proscribe the length of occupation. While a military function seems plausible, these structures could have also served as places of refuge for both people and animals in times of strife, particularly when they were not actively in use during military campaigns. Indeed, these interpretations need not be mutually exclusive.

7.3.3.3 THE GORGAN WALL FORTS AND EXTRAMURAL SETTLEMENTS

By contrast, a number of the sites lining the Gorgan Wall appear to have attracted extramural settlement (Fig. 7-7). This could suggest that the occupation within these features was of a more permanent nature than that of the so-called campaign bases. The interpretation of extra-mural settlements outside of Roman forts along Hadrian's Wall, and to the south of it, in northern England can provide useful potential parallels for the function of these settlements. Examples of extramural settlement, called vici, (as well as walled annexes and walled/enclosed *vici*) can represent military activity (especially the walled annexes), but in many cases were likely settlements housing civilians engaged in providing goods and services to the soliders of the fort (Bidwell and Hodgson 2009: 30-32).

At least 11 forts have features possibly indicating extramural settlement as noted on the CORONA imagery or during field visits; these features were confirmed in the field at four sites – Forts 4 (FORT_8), 16 (FORT_20), 18 (FORT_22) and 28 (FORT_32) (for a full list see Wilkinson et al. 2013 Table 3:4) and further examination of these features in the field is currently being undertaken. The extent of the outer settlements is difficult to estimate in all cases. The clearest example is Fort 28 (FORT_32) where what may be rectilinear structures are visible around the fort; extra mural settlement appears to cover an area of at least 10 ha. While the extents of the outer settlements at Forts 16 (FORT_20) and 18 (FORT_22) are far less clear, anomalies around the sites located on the imagery may cover areas of a similar or greater size, though the density or nature of settlement is difficult to determine. The size of settlements around forts could have been affected by the location of the fort, the environmental sub-zone in which it was located, proximity to contemporary sites etc. This will be discussed in more detail in section 7.4.

7.3.3.4 MODELS OF URBAN AND RURAL SETTLEMENT

As mentioned previously, sites attributed to the Sasanian period in the *GWS* outside of the morphological categories discussed above (e.g. large geometric sites) are few and far between. Sites from other surveys which could be confidently correlated to sites visible on the imagery or for which site size information was available appear to suggest that the majority of sites in this sample were less than 5 ha in size (between 70% and 80% taking into consideration the minimum and maximum site sizes visible on the imagery) (Table 7-3). In the Gorgan Plain, there may be an underrepresentation of lower relief settlements surrounding mounded sites due to modern agricultural activities, and this may have diminished the observable site size in some cases. As such, clear examples of Sasanian period settlement consisting of fortified rectilinear sites with extramural settlement as found in the Mughan Steppe, and interpreted as representing a dashkart type settlement complex; “the term originally described a small household and its associated land, but by the 5th century AD, it signified a rural estate, including a residence (often fortified), various outbuildings and irrigation infrastructure as well as the land it cultivated” (Alizadeh and Ur 2007 p.154) are difficult to clearly identify. Furthermore, the Mughan examples appear to be Sasanian foundations; in Gorgan there appears to have been considerable reuse of earlier period sites for known Sasanian occupation. Site sizes and morphologies associated with Sasanian settlement in the Merv oasis, derived from more intensive surveys, offer interesting comparative data as well (Simpson 2014 p.4–9). Of the 162 sites identified as Sasanian, the majority of were less than 4 ha in size, and therefore classified as villages or hamlets; 13 were over 4 ha, but less than 30 ha, and only three were in excess of 30 ha. Site morphologies included tappehs, *kalas*, and sprawling mound complexes, with the last type being largely unfortified. It therefore seems that defining rural site morphologies in the Sasanian period may not be a straightforward task. However, the data from Merv, and Gorgan, suggests that the settlement pattern may have been dominated by smaller sites, with only a few large towns and urban sites.

The gap in size between many of the sites attributed to the Sasanian period, and Dasht Qal'eh (GWS_54) is tremendous (See Table 7-5 which presents all sites over 30 ha in size). By any standard it appears that Dasht Qal'eh (GWS_54) was not rivalled in size in either previous periods, or within the Sasanian period itself, particularly if we assume a military or temporary function for the large geometric enclosures such as Qal'eh Kharabeh (GWS_1). As such it could be suggested that the decline in sites indicated for the Sasanian period in the Abbasi (2011) dataset, and to a lesser clear extent in the *GWS* data is potentially the product of rural decline in favour of population agglomeration within a large urban centre. However, there are several caveats that should be noted. Firstly, due to our knowledge of Sasanian period ceramics, this pattern may be mostly reflective of the 5th and 6th centuries AD when the Gorgan Wall, its forts, several of the large geometric enclosures, and possibly Dasht Qal'eh (GWS_54) as an urban centre, was constructed. Secondly, the lack of intensive survey may have resulted in the underrepresentation of low-level Sasanian period sites - that is non-tappeh based settlement. If so, then we may be seeing a decline in settlement on previously occupied sites, but not necessarily a drastic decline in the rural population in general (though the size of Dasht Qal'eh (GWS_54) does suggest that it may have drawn in a considerable number of people from the surrounding countryside). Without, a clear understanding of settlement patterns in the preceding period at all but the macro scale, it is difficult to comment on whether this potential reconfiguration of the settlement pattern represents an overall increase in population on the plain, though this does seem plausible. At the least it seems likely that the population of the plain would have increased significantly at particular times buoyed by military presence.

This pattern of course, especially in regards to the rural settlement, requires testing that can only be accomplished through intensive pedestrian survey over large areas of the plain, including intensive site based surveys that will allow us to begin to understand site development by period. However, several points in favour of this interpretation can be gleaned from a consideration of settlement distribution, and evidence (or lack therefore) for landscape investment.

7.4 SITE DISTRIBUTION, SITE MORPHOLOGY AND ASSOCIATED LANDSCAPE FEATURES

The pattern observable in the available dataset suggests that Sasanian period sites were concentrated either in the vicinity of the Gorgan Wall, or within c. 20 km of the Alborz foothills, leaving a notable gap in sites, particularly in the western steppe, and in the central plain between these zones (Fig. 7-1). There is a general decrease in site numbers from all periods as one moves north from the Alborz foothills toward the steppe (punctuated by an increase in site numbers in the vicinity of the Gorgan River in any of its stages), and while of course, the wall corridor has been more intensively studied (e.g. the GWP, Kiani's 1982 surveys and excavations), the recognition of sites from all periods within these 'gaps' within the Abbasi (2011) dataset, suggests that this pattern may not be a consequence of survey coverage alone. Recognition of Sasanian period ceramics may be part of this problem, and it needs to be considered whether this completely explains the pattern produced or if in fact this is a real trend in settlement location.

7.4.1 THE WALL CORRIDOR

The Gorgan Wall clearly mimics the line of the Gorgan River, particularly, if as discussed in chapter 6 (Table 6-8), the likely course of the Gorgan River in the western steppe during the Sasanian period was the Stage 3 palaeochannel (see Wilkinson et al. 2013 p.30). This channel may have diverged from the current course of the Gorgan River somewhere to the south of Forts 25 and 26 (FORT_29 and FORT_30 respectively) and run to the north of the Stage 2b palaeochannel, not far to the south of the Gorgan Wall. The wall therefore protected access to the river, and secured the arable lands in its vicinity.

A number of Sasanian sites appear to be located within close proximity to the Gorgan Wall and the Stage 3 palaeochannel in the western steppe (Fig. 7-8). But how do these sites relate chronologically to these features? It is perhaps easiest to consider the landscape contemporary with the wall first. Obviously, we have the numerous forts arrayed along the length of the wall. Extramural settlements are associated with several of these forts; Fort 28's (FORT_32) outer settlement was confirmed in the field, while evidence for outer settlements was noted on the imagery around Fort 30 (FORT_34), Fort 29 (FORT_29), Fort 27 (FORT_31) and Fort 25 (FORT_29) (see Wilkinson et al. 2013, Table 3:4 for a full list). The location of forts with confirmed or possible extramural settlement are presented in Figs. 7-8 – 7-10 and 7-22). Furthermore, we also have the possible use of the site of GWS_50, likely a Late Iron Age site, but clearly incorporated into the Sasanian wall defences (Kiani 1982b; Sauer et al. 2013; Wilkinson et al. 2013). This site, discussed, in more detail in Chapter 6, represents a site with clear morphological similarities to other Late Iron Age-Parthian sites – that is a clear central qal'eh surrounded by outer mounding. However, evidence from field survey and geophysics suggests that the Gorgan Wall was built around the qal'eh, enclosing it, but leaving the outer mounds beyond outside of it (Wilkinson et al. 2013 p. 124). The qal'eh, sitting at present at c. 16 m above the surrounding plain, may have provided a useful lookout point along the wall. As such, a particularly dense area of mid to late Sasanian period activity along the western wall-corridor zone is represented by this grouping of forts with extramural settlements, and GWS_50 (which sits between Fort 29 and 30 (FORT_33 and FORT_34)) (see Fig. 7-22). While, only speculative, this activity could be related to a possible crossing point of the wall (see 7.4.4.1)

The site of Qal'eh Kharabeh (GWS_1), discussed above as one of a number of large geometric enclosures possibly representing a campaign base, fort or other temporary refuge is located approximately 2 km to the south of the Gorgan Wall. The ceramics from Qal'eh Kharabeh (GWS_1) may suggest that it dated to the earlier part of the wall sequence (Sauer et al. 2013 p.351) and could indicate that its location and use had something to do with the construction of the wall. No evidence for permanent settlement either inside the structure or surrounding it is visible.

South of Qal'eh Kharabeh (GWS_1), GWS_2, and its possibly associated site of GWS_13 has also been dated by way of ceramics to the Sasanian period, likely contemporary with the Gorgan Wall, Qal'eh Kharabeh (GWS_1) and Fort 4 (FORT_8). Some differences noted in the assemblages (see Wilkinson et al. 2013 p.113, 115) may also suggest Early Sasanian occupation or differences in site use. GWS_2, a rectilinear qal'eh, is located within a meander of the Stage 3 palaeochannel and suggests that the river may have been exploited for defensive purposes either contemporary with the wall, or perhaps prior to its construction.

Indeed, a possible pre-wall defensive system along this palaeochannel, incorporating GWS_2, GWS_55 (a proposed Sasanian campaign base discussed above), and GWS_4 was suggested by Wilkinson et al. (2013 p.101–102). While no dating information is available for GWS_55, GWS_4 located to the north of the Gorgan Wall appears to have been primarily occupied in the Iron IV period, but early Sasanian material could not be ruled out (Wilkinson et al. 2013 p.113). Further features within such a system may also be suggested; two qal'ehs (ARNE_75 and TJW_8), are also arrayed along the course of the Stage 3 palaeochannel to the west and east of GWS_2 respectively, and were flagged up in the search for rectilinear qal'eh sites in the database. ARNE_75 consists of a prominent rectilinear qal'eh with a complex of lower mounding to the south, east and northeast. The qal'eh is immediately to the west of a loop of the Stage 3 palaeochannel. An older meander loop might enclose the site on the south, west and north side. Alternatively, this channel-like feature could represent a system for diverting water from the Stage 3 palaeochannel around the site, perhaps enclosing it in a protective moat. While no date has been assigned, surveys indicated prehistoric, red, and red-brown polished pottery on the surface, perhaps suggesting reuse of an older tappeh in the Iron Age or later (Shiomi 1976).

The second site, TJW_8, is a square qal'eh visited in the field by T.J. Wilkinson and Hamid Omrani Rekavandi. The imagery indicates a considerable palimpsest of indistinct features including archaic field systems, depressions and traces of possible mounding in the vicinity. What appear to be canals cut through this complicated mass of features; these canal-like features appear to be taking water off of the stage 3 palaeochannel, converging at (or running around) the qal'eh, and channelling the water over a considerable distance toward GWS_4. The qal'eh, itself has not been recorded by any other survey and no ceramic sample has been assessed.

Flagged up in the database search for rectilinear enclosures are two further sites that also appear to be closely associated with the river in the western and central parts of the plain and may form further nodes in this system. KH_149, located much further to the east is enclosed within a meander of the Stage 3 course of the Gorgan River. The site was dated to the Sasanian and Islamic periods by Abbasi (2011, Map 13 and Map 14), which further strengthens any dating assessment based on contemporaneity to the palaeochannel. At the very least, if we assume a defensive function for the palaeochannel, the site may have been constructed before the river course moved farther south at some time prior to, or at least by the Safavid period (see Table 6-8). While the only dating evidence suggests Islamic period occupation (Abbasi 2011 Map 14), KH_12, may form another node in this alignment. Situated to the west of GWS_55 and near the head of the South Canal, it sits to the north of the modern river, but immediately south of a set of relict meanders. These relict meanders obscure the start of the South Canal suggesting that it is later in date than the Canal (at least post Iron IV, if not later), and could therefore have plausibly been active in the Sasanian period protecting the northern side of the site.

Taken together the location of these features along the stage 3 palaeochannel and the use of the river for defensive purposes in several cases, may suggest contemporaneity. Prior to the building of the Gorgan Wall, the main obstacle in crossing the plain would have been the Gorgan River. Le Strange (1905 p.376–77), citing the Islamic geographer Mustawfi (14th century AD), indicates that "throughout its course the stream was deep, almost unfordable, so that travellers were often drowned in crossing it; and in flood-time its waters were carried off by channels and used up in irrigation, though much always ran to waste" indicating the abundance of water that flowed in the winter and spring months. In summer, though, the river may have been far lower making crossing much easier (Muraviev 1871 p.12). Howard-Johnston (2012 p.100), has suggested, that the Gorgan River did not have the same capacity to act as a defensive barrier as rivers such as the Euphrates or Tigris, and this may be true for part of the year. However, it would still have provided the only natural defensible feature in this otherwise flat landscape. While further ground based investigation is required (and planned) the data reviewed above presents an interesting configuration of sites, possibly exploiting the Gorgan River as a pre-wall, or even second, line of defence during the Sasanian era (Fig. 7-8).

The remaining sites with possible Sasanian occupation in this zone are minimal. In the *GWS* dataset, this included GWS_9, a small tappeh site to the south of the Gorgan Wall, but north of the Stage 3 palaeochannel that may have been occupied in the Early Sasanian period (Wilkinson et al. 2013 p.114). GWS_15, occupied primarily in the Iron III through

Parthian period, is the only other site north of the Gorgan Wall in the western steppe, besides GWS_4 with possible Sasanian occupation. This was observed in the field but not noted in the laboratory assessment; no material that could be associated with 5th- 7th century AD occupation was noted (Table 7-6). Clearly, there is a much stronger Iron III through Parthian component to north of the Gorgan River in this subzone of the plain (see chapter 6). In the Abbasi (2011 Map 13) dataset, a further three sites were indicated with Sasanian occupation. One could not be confidently associated with a site on the CORONA imagery, while the other two were multi-period complex topographic mounded sites of between 15 and 20 ha (NTS_104 and KH_151) located along the stage 2b palaeochannel (Fig. 7-8). These two sites in particular are deserving of future investigations as they may represent sites of a non-military nature within an otherwise highly militarized landscape zone.

To the east of Fort 25 (FORT_29), the course of the river appears to have changed less frequently, though relict meanders are visible (Fig. 7-9). The wall between Fort 25 (FORT_29) and Fort 15 (FORT_19) closely follows the River further supporting the stability of the channel. Between these two forts, a distance of c. 23 km, none of the forts appear to have extramural settlement. However, possible extramural settlement has been detected on the imagery surrounding Fort 21 (FORT_25), and confirmed in the field at Fort 18 and Fort 16 (see Figs. 7-7 and 7-9). Fort 21 (FORT_25) is c. 13 km from Fort 18 (FORT_22), which is c. 7 km from Fort 16 (FORT_20). As such, while there appears to be no regularlity in their spacing, the do not appear to be clustered as closely as the forts with extramural settlement along the western part of the wall corridor. A possible kiln was located in the vicinity of Fort 18 (FORT_22), but at both Fort 16 (FORT_20) and Fort 18 (FORT_22) , bricks and pottery were rare on the surface (Wilkinson et al. 2013 Table 3:4).

Two small rectilinear enclosure features identified in the database are also located south of, and in the immediate proximity of the wall along this stretch. KH_11 immediately east of Fort 22 (FORT_26), and KIA_28, c. 400 m south of Fort 17 (FORT_21), both measuring c. 1 ha in size. Their shape and proximity to the wall are suggestive of contemporary activity, although no independent dating information exists.

To the north of the Gorgan River, in the central steppe sub-zone, we again have two sites that may possibly have material relating to a Sasanian horizon, though the evidence is somewhat limited (Table 7-6). Kiani (1982b) attributed GWS_6 to the Prehistoric, Parthian and Sasanian period, and the limited illustrations of grey ware from the site do little to confirm or reject this assessment; the *GWS* laboratory assessment suggested possible Bronze or Iron Age occupation related to, but not identical to the material from Qelich Qoineq (GWS_16) (see Table 6-1). GWS_7 on the other hand was suggested to perhaps date to either an Iron age or Early Sasanian horizon in the *GWS* laboratory assessments, though further study of the ceramics from the site are needed to clarify. Again, while occupation north of the wall in the Sasanian period is difficult to confirm, it does seem that there is no evidence for activity comparable to the period in which the wall was in use.

Three sites with a possible Sasanian component are arrayed along and immediately to the south of the Gorgan River between the above mentioned forts. The only one visited by the *GWS* is the site of GWS_31 (Bibi Shervan) a multi-period site, with clear Iron IV and Parthian occupation, with some evidence for Early Sasanian presence, though possibly quite limited in area (Wilkinson et al. 2013 p.120). The prominent roughly rectilinear mound visible on the imagery only represents one part of a much larger site as evidenced by mounding to the north and east now partly eroded out by a relict meander of the river. A considerable area of relict field systems surrounds the site to the south, but it is impossible to associate these with a particular phase of occupation without further field survey. A similarly prominent, polygonal multi-period tappeh (KH_66) with Sasanian occupation (Abbasi 2011 Map 13) is located south of the River c. 5 km to the east, also with traces of similar archaic field systems to its south. Further to the east, KH_4 a complex configuration of mounds and archaic field systems is visible on the imagery and was mapped from aerial photos by Kiani (1982b Map 3-4). At least one of the mounds within this grouping has been dated to the Sasanian period by Abbasi (2011 Map 13), but the entire grouping has components ranging in date from the Bronze Age to the Islamic period and correlating individual parts of the site to particular periods is difficult. The longevity of settlement at these sites and our current inability to distinguish settled area by period makes it difficult to ascertain the nature or scale of Sasanian activity at these sites, and it is possible that field systems may relate to earlier or later occupation. However, beyond these sites (all located immediately south of the river) there are none attributed to the Sasanian period south of this point for between 10 and 20 km.

Moving further east along the wall, evidence for outer settlements surrounding Gorgan Wall forts is limited, particularly between Forts 15 (FORT_19) and 5 (FORT_9). Activity in the vicinity of Fort 14 (FORT_17), however, is interesting. Immediately north of the fort on the north side of the wall is a geometric enclosure or Fort (designated Fort 14 A (FORT_18)), while south east of Fort 14 (FORT_17) another c. 4.5 ha geometric enclosure was visited in field survey, but no ceramic sample was retained (see Fig. 7-5 A and B). These features are all clearly visible on the imagery and were mapped by Kiani (1982b) from aerial photographs. No independent dating exists for these geometric enclosures, but their proximity to the wall and each other is notable.

To the east of modern Gonbad-e Kabus and to the north of the wall, are a number of sites to which possible Sasanian components have been attributed. This zone, the eastern dry farming zone, was discussed in detail in chapter 6 in relation to the pattern of settlement and land use that appeared to be associated with Iron III through to Parthian, and possibly Islamic occupation. Table 7-6 indicates nine sites in this sub-zone suggested in various datasets to have Sasanian period occupation; all of these sites have been visited by the *GWS* (Fig. 7-10; see also Fig. 7-1 for an illustration of the site locations and dating certainty). For seven of these sites, a possible Sasanian date was assigned during initial spot dating made in the field by the *GWS*. When the *GWS* samples from six of these same sites were assessed in the laboratory (ceramics from two of the nine sites, GWS_19 and GWS_44 did not undergo a laboratory assessment), however, no evidence was found for a horizon that appeared contemporary to the Gorgan Wall, Qal'eh Kharabeh (GWS_1) or Fort 4 (FORT_8). At one of these sites though (GWS_25) an early Sasanian horizon could not be ruled out (Table 7-6). It is important to note that the laboratory assessment of the pottery was carried out in the 2009 season after our understanding of the mid- to late Sasanian sequences associated with Qal'eh Kharabeh (GWS_1) and Fort 4 (FORT_8) had been well-established enabling the refinement of sites previously dated to a possible Partho-Sasanian horizon.

Interestingly, Abbasi (2011 Map 13) indicates that four sites in this zone were occupied in the Sasanian period (GWS_19, GWS_20, GWS_21 and GWS_22). However, as stated above, at GWS_20, GWS_21 and GWS_22, no evidence for Sasanian settlement was found in the *GWS* laboratory sample, and no Sasanian material is mentioned by Kiani (1982b). Possible Sasanian occupation at GWS_19 cannot be clarified further based on the currently available data. Of note, however, is that all of the sites assigned to a Sasanian horizon by Abbasi (2011) in this zone are located in the western group ('group one' in the discussion of sites with hollow ways in chapter 6). This is the zone in which the evidence reviewed in chapter 6 suggested was occupied more frequently than the more eastern area of the 'group two' sites (e.g. GWS_25, GWS_26, GWS_27, GWS_44) and hollow ways in the eastern dry farming zone.

Overall, it seems that if some occupation continued in the eastern dry farming zone into the Sasanian period, it was clearly on a relatively small scale and was likely restricted to the Early Sasanian period. This is further strengthened by the fact that hollow ways emanating from GWS_25 are cut by the Gorgan Wall (see Fig. 6-25). This would suggest, at the least, that the fields in the vicinity of the site were no longer enclosed (in use?) by the time the wall was built.

7.4.2 CANALS ASSOCIATED WITH THE GORGAN WALL

This picture is further emphasized by the nature of Sasanian period canal systems associated with the Gorgan Wall. The Wall is fronted on the northern side by a ditch that contained water for at least part of the time that the wall was in use. Water in the ditch flowed from east to west and was shown to have been supplied by at least five canals (and one likely aqueduct), which took water from the Gorgan River or the streams that fed into it; these were identified on the CORONA imagery and visited in the field (Wilkinson et al. 2013 p.69–80). All of the supplier canals (and possible supplier canals) mentioned above are located in the eastern half of the plain. These are summarised in the Table 7-7, and their locations given in Fig. 7-11. Further inspection of the CORONA and modern high-resolution imagery available on Google Earth has identified several other canals that may have supplied water to the Gorgan Wall ditch. The descriptions and evidence for their interpretation are also presented in Table 7-8.

Taking into consideration the gradient of the wall ditch, the canals feeding into it could only have supplied water to the forts downstream. The farthest east example of a possible wall feeder canal is at Fort 4 (FORT_8). This feature could have supplied water to the wall and to the Fort. Immediately east of Fort 5 (FORT_9), the wall would have had to negotiate the Kal Ajay River which flows into the Gorgan. While far less clear on the imagery, a linear feature traversing the river valley along the line of the wall is visible, and ground-truthing of the feature found robber pits where bricks had been removed; if the ditch to the north of Fort 5 (FORT_9) was filled with water, it did not come from the same source as that of

Fort 4 (FORT_8). No evidence for water supply to the wall is evident to the west of Fort 5 (FORT_9) until one encounters the Chai Qushan-e Kuchek Canal supplied via the Kal-e Garkaz canal and the Sadd-i Garkaz aqueduct (see Wilkinson et al. 2013 p. 72-80, Fig. 3:48 and 3:50). As such, there is currently no indication of water supply to the wall between Forts 5 and 6 (FORT_9 and FORT_10). However, branch canals of the Chai Qushan-e Kuchek Canal may have supplied Fort 7 (FORT_11) (and possibly Fort 8 (FORT_12)) (Wilkinson et al. 2013 p.76). However, c. 900m to the west of Fort 7 (FORT_11), another possible canal feature has been located on the CORONA, and modern imagery, leading from the Gorgan River toward the wall (Fig. 7-12). If this represents a further feeder canal, it could have supplemented water flow along the ditch between Forts 7 and 8 (FORT_11 and 12). Its faint signature may suggest it was in use for a shorter period of time, or has been subject to different post-abandonment processes.

Hints about earlier phases of water systems along the wall's course can also be found in the vicinity of the Aqabad canal, between Forts 8 and 9 (FORT_12 and FORT_13). Near where the Aqabad canal takes its water from the Gorgan River is what appears to be the start of another canal-like feature heading toward the wall ditch (Fig. 7-13). However, the feature appears to continue under the Gorgan Wall suggesting that it was in use prior to the wall's construction. It may represent a canal, built prior to and out of use by the time the wall was constructed. If so, this is intriguing. Is it an Early Sasanian feature? Or is it much older? Perhaps it is another example of the type of canal system that appear to have been in use between the later Iron Age and the Parthian periods (see Fig. 6-11 and Fig. 7-11 which illustrates canal systems by period). If so, why was it not reused to feed the wall ditch? A second hypothesis is that this feature is a hollow way in use before the construction of the wall. If so, then it is possible that the feature immediately east of the Aqabad canal is a pre-wall hollow way leading to the Gorgan River, and the point where it met the river may have been a useful starting point for a later canal. Moving east, a third linear anomaly is visible on the imagery. In this case though, it appears only as a dark line for most of its length, and no upcast banks are visible. It meets the Aqabad canal near the same point as the first anomaly, before turning north-west toward the Gorgan Wall. The anomaly fades out c. 200m before reaching the wall. It is difficult to say if this is another (albeit far less well preserved) canal or some kind of track. However, there is no evidence for it extending beyond the wall or aligning with other hollow ways in the area. At the least, while the main branch of the Aqabad canal was active it could have supplied water to the ditch to the north of Fort 9 (FORT_13).

The next clear example of a feeder canal is the Sarli Makhtum located between Forts 9 (FORT_13) and 10 (FORT_14), and which would have supplied water along the ditch to the north of Fort 10 (FORT_14) (Fig. 7-14). Possible canal features running parallel to the wall and possibly supplying water to Fort 10 (FORT_14) are also found. For example, a linear anomaly was located on the CORONA imagery running from east of Fort 9 (FORT_13) (not far from the start of the Aqabad canal) to west of Fort 10 (FORT_14). This feature runs perpendicular to the Sarli Makhtum canal and may represent a canal or a hollow way (Wilkinson et al. 2013 p.80). If a canal, it is possible that it took water from the Gorgan River to the south west of the Aqabad canal, fed into the Sarli Makhtum canal and then continued west, with a possible branch supplying Fort 10 (FORT_14). Another canal feature is also visible leading from the Gorgan River to the west of the Sarli Makhtum toward this feature. However, it is also possible that this system represents a different phase of water supply wholly unrelated to the wall, and the Sarli Makhtum Canal.

Another possible canal feature associated with the wall has been located in the vicinity of Fort 14 (FORT_17) (Fig. 7-15 and Fig. 7-16). Extending from the Gorgan River within the ruins of the Islamic period site of Jurjan (KH_138) toward the northwest and the Gorgan Wall, this feature may skirt to the south of Fort 14 (FORT_17) before turning to the wall. It does not appear to extend beyond the wall. While it may be related to water supply for the wall, it may also have been associated with field systems in the vicinity of Jurjan (KH_138) in the Islamic period (or both). If this feature represents another example of a wall ditch feeder canal, then it would fill in a considerable gap between the Sarli Makhtum canal and the Band-e Vali Canal to the west of Fort 17 (FORT_21). From this point, there is little evidence for feeder canals along the course of the wall. A possible exception is what may be a canal-like feature leading from the Gorgan River to immediately east of Fort 21 (FORT_25) (Fig. 7-17).

Linear anomalies, however, have been recorded running parallel and to the south of the Wall in the vicinity of to Qizlar Qal'eh (GWS_50, an earlier Iron Age site incorporated into the wall's defences) and Tokhmoq Tappeh (GWS_4). Wilkinson et al. (2013 p.80) suggested that the water supply for the Sasanian site of Qal'eh Kharabeh (GWS_1)may have come from a section of the South Canal (discussed in chapter 6, and likely constructed sometime between the Late Iron Age and the Parthian period) via a water collection point immediately south of the Gorgan Wall that was used or reused into the Sasanian period. If this was the case, then it may also explain the location of another canal-like feature running parallel to the Gorgan Wall toward the site of Qizlar Qal'eh (GWS_50) and further to the west (Fig. 7-18). If, after the wall was built, the section of the South Canal, south of the wall, was re-used, it could have supplied water, not just to Qal'eh Kharabeh (GWS_1), but to Fort 29 (FORT_33), Qizlar Qal'eh (GWS_50) and Fort 30 (FORT_34). This canal-like feature (and perhaps an earlier version running parallel and immediately north of it) cuts a hollow way extending from the outer mounds of Qizlar Qal'eh (GWS_50); while not independently dated, it can be demonstrated that these hollow ways tend to be a characteristic of Late Iron Age through to Parthian sites (see Chapter 6) suggesting that the canal-like feature is later in date (Fig. 7-19). The line of this feature continues roughly parallel to the wall (northwest) for another 1.5 km from the visible western edge of Qizlar Qal'eh (GWS_50) before diverging from the wall slightly and heading west toward the outer mounding associated with Fort 30 (FORT_34), observable as a faint dark line. Beyond Fort 30 (FORT_34), the feature again more distinctly resembles a canal, and appears to run for another nearly 3 km before perhaps debouching into the Stage 3 channel of the Gorgan River (Fig. 7-19). Approximately 1 km prior to this, a branch may lead to the Gorgan Wall ditch. Here, it has been shown that the original course of the wall was altered and moved c. 200m to the north perhaps to avoid the destructive effects of the Gorgan River (Wilkinson et al. 2013 p.59). As such, this feature, if a canal, appears to be associated with the phase of this alteration of the wall. The likelihood of its interpretation as a canal, rather than a hollow way feature, may be strengthened by the lack of evidence for cultivation along the wall corridor, and conditions (enclosed fields) that may have seen the formation of set paths through the landscape.

In summary, what does this evidence say about the nature of the water supply to the Gorgan Wall and its forts? With the exception of the possible canals immediately beside Forts 4 (FORT_8), and 21 (FORT_25) all of the canals that feed into the wall ditch are located on stretches of the wall between forts. This suggests that water supply to the forts was a secondary concern and may have been achieved by the later construction of branch canals off of the main feeder canals, as is the case for the Chai Qushan-e Kuchek that possibly fed water to Fort 7 (FORT_11). As the soldiers inhabiting the forts would also have likely had access to ground transport (pack animals or carts), as long as water sources were not too distant, water could have been supplied to the fort in other ways. This is supported by the proposed sequence of construction for the wall in which the wall and forts were the last elements that started with the wall ditch, water supply, and the use of the excavated material and water for the manufacture of bricks (Wilkinson et al. 2013 p.101). While water resources may have been a consideration in the placement of forts along the Gorgan Wall, spacing may also have been determined by topography, routes, crossing points of the Gorgan River and other factors. Furthermore, it is possible that some sections of the wall ditch never carried water. Hints about the evolution of water systems along the wall are also indicated by the possible phasing of features near the Aqabad canal or perhaps in the vicinity of Forts 9 and 10. Other evidence for the evolution of water systems along the wall in this vicinity can be gleaned from excavations at Fort 4 (FORT_8) and 9 (FORT_13), which indicate that at some point while the wall was still in use the wall ditch to the north of these forts no longer carried water; because these forts would not have relied on the water from the same feeder canals, however, it is difficult to say if this occurred at the same time (Sauer et al. 2013 p.185). Overall, this evidence demonstrates that the wall ditch and the feeder canals may have had short active lifespans, and it is possible that some canals could have remained active for much longer than others.

The evidence also suggests that these water systems were not associated with large-scale irrigation along the wall corridor, nor does there seem to have been much in terms of investment in irrigation in the landscapes to the north following the construction of the Gorgan Wall. The investment in this landscape for agriculture as seen in the earlier Late Iron Age – Parthian horizon, does not appear to be replicated in the Sasanian period. Interestingly, even canal systems to the north of, and taking their water from the modern course of the Gorgan River, are limited in the western steppe and on a much smaller scale than in previous periods. For example, a canal taking water off the modern Gorgan River south of the village of Gharinjig Poor Aman is visible on the CORONA imagery (Fig. 7-20). The canal heads west southwest for c. 1 km before turning northwest for c. 2.7 km then turning southwest and entering what appears to be an area of field systems and running for a further 3.6 km. Another branch near where the canal turns southwest appears to head toward the site of ARNE_133. Limited dating evidence is available but two surveys did indicate that Islamic material was present on the site (Arne 1945; Shiomi 1976; 1978), and it is likely that the channel of the river associated with the site was not active prior to the Ilkhanid period (Wilkinson et al. 2013 p.30–31). Another example can be found further to the east near the start of the North Canal (Fig. 7-21). A canal appears to take water off the course of the Gorgan River, through an area of relict fields, and past two sites (KH_10 and ARNE_12) for which the only available dating evidence indicates Islamic occupation (Arne 1945). The canal then continues to the west, cutting the palaeochannel of the Gorgan River that fed the North Canal and fading out south of the Gorgan Wall. While the dating is speculative at this stage, the possibility of these channels being associated with Islamic period or later settlement is high.

In summary, there are substantial canal systems associated with the Gorgan Wall, but minimal evidence for their use in irrigating agricultural land in the vicinity. They might have, in addition to feeding the wall ditch, crucial to supplying water to forts and fortifications along the wall corridor. Examples of smaller canal systems within this zone do not appear to be associated with the wall system and may date to a later period.

7.4.3 THE CORE SETTLEMENT ZONES

As mentioned, in the western and central parts of the plain there is a significant gap between sites attributed to the Sasanian period along the wall corridor discussed above, and those within c. 20 km of the Alborz foothills (Fig. 7-1 and 7-22; see Chapter 7.4.1). This gap disappears in the eastern end of the plain, with the narrowing of the distance between the Alborz Mountains and the Gorgan River. The density of sites within these southern subzones of the plain is greater than along the wall corridor and it is likely that these areas formed the core settlement zones within the Sasanian period.

In the western and central part of the plain, all Sasanian period occupation appears to be restricted to the alluvial fans extending out from the Alborz. In the west, the northern limit of occupation is also defined by the Qara Su River, which gathers its waters from streams flowing down from the Alborz before turning to the southwest and eventually debouching into the Caspian Sea to the south of the Gorgan River. These piedmont plains are well watered by rainfall, which ranges between 400-600 mm (as opposed to the plains that are well-watered by the Gorgan and Qara Su Rivers further north), and form the modern core irrigated cultivation zone of the plain (Van de Weg et al. 1968). The only two sites in this zone with Sasanian occupation confirmed by the *GWS* or by excavations are GWS_35, a mounded site with attached large square enclosure, and Tureng Tappeh (KH_123); both sites with an established or proposed defensive function. However, we know little about settlement, or landscape features in their immediate vicinity, securely datable to the Sasanian period, that could tell us about investment in agriculture or irrigation. GWS_35 does have a canal feature that extends from the northwest toward the northern side of the enclosure before following it to its northeast corner and extending off toward the east-southeast. The alignment of the feature with the northern enclosure wall suggests contemporaneity of the features at some point, but this could also have been when the enclosure wall was in a ruined state (see Fig. 7-2 for an image of GWS_35 and the canal feature). Within this zone to the south of Forts 17 (FORT_21) to 15 (FORT_19), two of the large geometric enclosures with no internal features are located – both Qal'eh Daland (GWS_53) and KH_84, which are possibly attributable to the Sasanian period based on morphology.

To the east of Fort 15 (FORT_19), and in the vicinity of modern Gonbad-e Kabus, settlement density increases, while the distance between the Gorgan River and the Alborz mountains decreases leaving no gap in settlement between the Wall/River and the plains to the south. Within this comparatively narrow strip of plain we find the greatest concentration of sites attributed to the Sasanian period, including three large rectilinear enclosures dated to the Sasanian period by the *GWP* (Gabri Qal'eh (GWS_49), Qal'eh Gug A (GWS_33), Qal'eh Pol Gonbad (GWS_37), as well as the proposed urban centre of Dasht Qal'eh (GWS_54). The evidence for extramural settlements surrounding Gorgan Wall forts in this zone (between Forts 15 (FORT_19) and 5 (FORT_9)) is limited. Only Fort 9 (FORT_13) may have had some activity outside its walls (Wilkinson et al. 2013 Table 3:4). This seems to be directly related to the proximity of settlement to the wall in this sub-zone and is in contrast to the central and western part of the plain, where limited activity in the vicinity of the wall may have resulted in the formation of extramural settlement around forts. Further supporting this is the drop-off in site density to the south of the Gorgan Wall as one moves east of Fort 5 (FORT_9), and the appearance of extramural settlement around Fort 4 (FORT_8) and Fort 2 (FORT_6) (Fig. 7-10). The available data therefore suggests that as in earlier periods, the sub-zone located at the eastern end of the plain south of the Gorgan River forms the core zone of settlement during the Sasanian period.

7.4.4 IRRIGATION AND THE CORE SETTLEMENT ZONE

Unlike along the wall corridor, there are no clear examples of large-scale canal systems in the southern part of the plain, and in particular ones that can be confidently associated with the Sasanian period. There are examples of canals associated with several of the large military or urban sites, however. At Gabri Qal'eh (GWS_49), a possible canal enters through the northwest side of the site and at Dasht-Qal'eh (GWS_54) there may have been a canal that fed the surrounding ditch (Sauer et al. 2013 p.387). These examples though do not provide any evidence for irrigation.

Is the apparent lack of large-scale canal systems associated with irrigation in the southern part of the plain a result of poor preservation, or did they simply not exist? Higher rainfall in the regions just north of the Alborz Mountains means that large-scale irrigation systems like those found in the western steppe were not necessarily required for agriculture. Indeed, alluvial fans are well-suited to dry-farming, and with minimal investment in irrigation (such as simple barriers or dams across streams) are even more productive; such systems have been investigated by Petrie and Thomas (2012) and appear to be important to the development of early village sites across the Near East and South Asia.

However, crops could be guaranteed, or production intensified by the use of more intensive forms of irrigation as demonstrated by 19th century AD accounts and modern practices (Okazaki 1968; Van de Weg et al. 1968). Okazaki writing in the 1960s suggested that:

> "In the Gorgan area, blessed with favourable precipitation, satisfactory returns were brought even with dry farming. But, as the best scheme to raise production was the acquisition of water at a proper time, the farm operators invested money in irrigation facilities. Although *qanāts* had been the principal irrigation means, much of the new investment was applied to digging artesian wells 20 to 30 m deep, tube-wells 20 to 130 meters deep with pumping equipment and even some reservoirs. In addition, where river water was available, the installation of pump plants was carried out. Some pioneering farms adopted a sprinkler irrigation system. Hitherto, only a few farms had had irrigation means, mostly *qanāts*; however after 1959 almost all of the farms had these new irrigation facilities, which required a large amount of money" (Okazaki 1968 p.22).

As Okazaki suggests, much of the water for irrigation in the southern part of the plain, at least for the last few hundred years and up until the mid-20th century AD, appears to have been supplied by qanats. Hundreds of qanats have been mapped on the CORONA imagery; almost all are concentrated within c. 20 km of the Alborz foothills, and the density is at its highest in the eastern end of the plain (Fig. 7-22). A recent survey recorded 297 qanats in Golestan province (Semsar Yazdi and Labbaf Kaneiki 2012 p.90) though there has been a sharp decline in their use and maintenance over the course of the 20th century AD as evidenced by the difference in the preservation of the upcast mounds on aerial photos from the 1930s (Schmidt 1940 Plate 71), the CORONA imagery taken in the 1960s and the imagery available on Google Earth from the last 10 years (Fig. 7-23 and 7-24).

Most of the qanats visible on the imagery appear to originate in the piedmont plains and extend out to the edge of the alluvial fans discussed above. They also appear to be concentrated along (palaeo)channels (Fig. 7-22). None of the qanats mapped exceed 5 km in length and the majority are between 0 and 2 km in length (though it is possible that some of the shorter visible segments may be parts of longer qanats). Parallel qanat lines, or abrupt truncations and changes in course may indicate the collapse of one line and its rejuvenation nearby, further indicating the longevity of their use in the area; examples of this practice were suggested in discussions with local informants (Fig. 7-25). Determining the recipients of their water is difficult as only a few can be confidently associated with archaeological sites on the imagery; furthermore, the multi-period nature of many sites makes association to a particular period difficult and the preservation of the features provides us with only a partial picture.

The dating of these qanat systems is therefore difficult to establish with certainty and they likely represent use and reuse over a considerable period of time (with some still in use today). The origins of qanat technology may be found in Iran, and its dissemination linked with the expansion of the later territorial empires (Achaemenid period onwards), though multiple centres of origin have also been proposed (Lightfoot 2000; Magee 2005). Textual evidence for qanat use in Northern Iran is arguably found in Polybius X.28 (writing about events in the latter half of the 3rd and first half of the 2nd century BC) which describes a system of below ground channels and wells on the southern side of the Alborz (Briant 2001; Christensen 1993 p.135). However, conditions are much wetter on the northern side of the Alborz, than on the south, and the impetus for, and timing of, qanat use could be very different in these different environments. Currently, the date for the earliest use of qanats in the Gorgan Plain is unknown. Palaeoenvironmental data suggests that at least in the eastern end of the plain, human impact on the environment, and in particular the cultivation of tree species, appears to have hit its maximum sometime between the Parthian period and c. 1000 AD (Shumilovskikh et al. 2016 p.13–14). This may suggest that irrigation may have become increasingly important sometime over the course of the 1st

millennium AD for intensifying production – this may have involved both canal and qanat irrigation.

While a full analysis of qanats, and potential site associations constitutes a research project in its own right and is beyond the limitations of this thesis, the preliminary data may suggest that the peak in qanat use post-dated the Sasanian period. At Gabri Qal'eh (GWS_49) for instance, a qanat clearly leads through the outer ramparts of the site on its northwest side. It does, however, appear to cut the ramparts (and possible earlier canal) suggesting that it is later in date than the rampart's original construction. Similarly, a qanat appears to traverse the rampart in the southwest corner of Dasht Qal'eh (GWS_54). Both of these sites have evidence for significant Islamic period occupation.

While the correlation between the core zones of settlement in the Sasanian period and the location of the qanat systems (extending along the alluvial fans) in the plain is suggestive (see Fig. 7-22), an association based on location alone would be spurious. A similar distribution with a much higher site density appears to characterize the known Islamic period pattern of settlement where the most intensively occupied areas again correspond to the distribution of qanat systems (Fig. 7-26). At the least, the Sasananian and Islamic settlement patterns appear to fit better with qanat distrubtion in the western piedmont zone than the Late Iron Age – Parthian distrubtion (See Fig. 6-31). It does not, though, rule out the use of qanats in earlier periods. However, these settlement patterns are representative of very long-chronological periods and likely mask more subtle trends with which we could make associations.

A peak in qanat use in the Islamic period (possibly Middle Islamic) would fit with a proposed rise in the exploitation of this technique on the southern side of the Alborz (Bulliet 2009). Interestingly, Trinkaus's (1983 p.126–127) surveys on the Damghan Plain (on the south side of the Alborz) indicated that the distribution of Parthian and Sasanian sites was better correlated with river-irrigated areas than with artesian wells or qanats leading her to suggest that:

> "Partho-Sassanian period occupation, therefore, centres on the river-formed zone of most readily available water and most easily cultivated lands. Since the river currently supplies about 20% of the available water of the Damghan area, with the remainder coming from aquifers, springs and qanats, this suggest rather less than maximal exploitation of water resources here during the Parthian and Sassanian periods".

While the level of water exploitation is difficult to comment upon for the Gorgan Plain during the Sasanian period, it does seem that irrigation systems which enabled the expansion of settlement in more arid zones (i.e. the steppe margins) was not a priority. This strategy can be compared with that employed in other regions of the empire such as Southern Mesopotamia (Adams 1962) and the Mughan Steppe in northwest Iran (Alizadeh and Ur 2011) where intensification of agriculture through irrigation systems was key. These patterns will be explore in more detail in Chapter 8.2.3.

7.4.5 FRONTIERS AND CONNECTIVITY [31]

By using the information on settlement patterns and landscape features discussed above we can also begin to reconstruct how this frontier zone was connected to other regions both within the empire and beyond it. It seems plausible that accompanying the landscape transformations detailed above, there may have been a similar level of investment in a network for the transport of people and goods. Routes within and beyond the Gorgan Plain are mentioned in texts from the Antique through to the Islamic periods (Isidore of Charax 1914 p.8–9; al Muqaddasi 2001 p.291; Le Strange 1905 p.380). However, there is often very little physical evidence for the routes themselves. Maps and descriptions of the region by 19th century AD European travellers are more specific, but of course reflect an anachronistic political and cultural landscape (see Baker 1876; Muraviev 1871; Napier and Ahmad 1876; Vambery 1864 p.80–81). However, using this information in combination with archaeological evidence gathered from field survey and the remote sensing of satellite imagery can help us to reconstruct potential route systems of the Sasanian era.

7.4.5.1 INTERREGIONAL ROUTE SYSTEMS AND IMPERIAL INVESTMENT

The most obvious evidence for ancient route systems are the physical manifestations of the routes themselves. In some cases, the restrictions of topography allow us to more easily identify major routes through the landscape. For example, the Dariali Gorge, straddling the border between modern Georgia and Russia, has been a key route through the Caucasus Mountains since antiquity; historical sources and current archaeological investigations

[31] The majority of this section has been submitted as a chapter entitled “Connectivity on a Sasanian frontier: Route systems in the Gorgan Plain of north-east Iran” in the edited volume *Sasanian Persia: Between Rome and the Steppes of Eurasia* (which will be published by Edinburgh University Press in 2017).

indicate that control of this pass, via fortifications such as the Dariali Fort, appears to have been important to local kingdoms and foreign powers, including, from the 3rd century AD, the Sasanian Empire (Sauer et al. 2015) (Fig. 7-27). While many local routes exist within the landscape, regional routes that would ensure the expedient movement of people and goods are constrained by topography. While not impassable, the Alborz Mountains similarly form a significant barrier to movement; traffic between the Gorgan Plain and the Iranian Plateau, both today and in the past, is restricted through a few defiles (Fisher 1968 p.38). This allows us to identify the most obvious crossing points between the plain and the Iranian plateau.

North of the Alborz Mountains, however, the wide, flat Gorgan Plain presents few natural limitations to movement. Prior to the building of the Gorgan Wall, the main obstacle would have been the Gorgan River dissecting the plain from east to west, which appears to have been difficult to cross at least at certain times of year. Furthermore, the wall could have channelled movement along it, connecting forts along the wall. Limited evidence for such a route in the form of hollow ways currently exists, but traces, particularly near Fort 10 (FORT_14) have been previously suggested (Wilkinson et al. 2013 p.80). On other frontiers where linear boundaries such as long-walls, rivers, canals or ditches are found, evidence for crossing points of these features can represent nodes along route systems[32]. For example, a ford crossing the Wadi Jaghjagh in the Khabur basin of eastern Syria, a region which formed a frontier zone between the Roman/Byzantine and Sasanian Empires, may represent such a node in a postulated Late Antique route system (Oates and Oates 1990; Simpson 1996) (Fig. 7-27). Interestingly, at certain times the wadi may have demarcated a military frontier. Of further interest are two rectilinear fortifications, known as the Castellum and Sabakh, sitting on either side of the river near the ford. Limited ceramic finds from the Castellum (on the west bank) and architectural similarities between Sabakh (on the east bank) and forts on the Gorgan Wall may suggest that the former was Roman and the latter Sasanian. However, in this dynamic and changing frontier zone these affiliations will have changed through time as suggested, for example, by the density of

[32] Equally, alignments of sites, and landscape features, as well as linear boundaries, can also be interpreted as corridors of movement (Parker 2002 p.373; Smith 2005). Lawrence (in press) has presented a convincing argument for a potential Sasanian route system in modern Azerbaijan following a line of fortified sites that form nodes in a larger imperial network in the Caucasus.

(likely) Late Sasanian occupation on both sides of the river. The maintenance of the ford through time (possibly from the 4th millennium BC onwards), however, suggests that cultural and economic links likely transcended actual or perceived military or political boundaries. Travel accounts from the 19th century AD mention fords and small boats being utilised for the crossing of people and animals (Muraviev 1871 p.12; O'Donovan 1882 p.291), and it is likely that fords similar to the one near the Castellum and Sabakh in the Khabur could be found at numerous points along the river. The identification of pre-modern bridges or fords is hampered by the highly active nature of the river. Besides the seasonal flooding, erosion of the loess soils along the river banks is common while the many palaeochannels and relict meanders visible on the CORONA imagery and in the field, particularly in the western plain, provide evidence for channel changes at multiple scales (Wilkinson et al. 2013 p.30–32, Fig. 3.7). However, bridges spanning the river are known in Jurjan (KH_138) from the Islamic period (Kiani 1982b Fig. 1; Le Strange 1905 p.377 citing Ibn Hawkal; Muqaddasi 2001 p.291).

The Gorgan Wall, however, provided a much more reliable barrier to traffic. It also would have channelled movement across the frontier through controllable crossings. Following the course of the river, the wall, built several kilometres to the north, secured the river's resources, both for supplying the water-filled ditch on the north side of the wall and probably for irrigating the lands to the south. After the construction of the wall, routes crossing the frontier would have had to negotiate not only crossing the river but also crossing the wall and ditch, likely through well-monitored gates. The Gates of Sul, mentioned by al-Tabari in the 9th century AD but in reference to supposed events in the later 5th century AD, may possibly refer to a gate on the Gorgan Plain. Bosworth (al-Tabari 1989 p.113) suggests the gate controlled traffic coming from the north and travelling through Dehistan (southwest Turkmenistan), Gorgan and eventually onto the Iranian Plateau. More specifically, it is possible that these gates may refer to a gate in the Gorgan Wall as proposed by Sauer et al. (2013 p.4).

Because, the clearest feature that survives on the imagery is the wall ditch, not the wall itself, locating gaps or gates in the wall from an inspection of the CORONA satellite imagery available for the region is difficult. No evidence for bridges crossing the ditch has been found. However, it is possible that features such as canals or forts that are numerous along the wall's length may have served also as gates or crossing points. Besides canals being conduits of movement in their own right, routes along them are also well known in the ancient and modern Middle East (Smith 2005 p.841; Wilkinson et al. 2013 p.80). Gaps in the wall to accommodate these canals, such as where the Sarli Makhtum canal flows into the wall ditch, could have provided access through the wall if a bridge over the ditch were constructed (Wilkinson et al. 2013 p.76) (Fig. 7-28, 7-29). The Chai Qushan-e Kuchek canal also connects to the wall ditch, and furthermore is fed by an elaborate system involving the transport of water along the Kal-e Garkaz canal and along an earthen aqueduct called the Sadd-e Garkaz, which then may have spanned the Gorgan River via a bridge (Wilkinson et al. 2013: 73-76) (Fig. 7-28). Whether or not crossing both the river and wall were achievable along this alignment is open to speculation. However, canals which meet the wall ditch near forts (such as at the Band-e Vali Canal, or the possible canal feature west of Fort 4 (FORT_8)), might be far more plausible candidates as crossings when the wall was active, for the purpose of security and taxation (see Appendix B for image of Fort 4; see also Fig. 7-11). The antiquity of other gaps in the wall ditch not associated with canals or forts are difficult to determine, and while potentially original, they may also be the result of subsequent activities (e.g. road building, agriculture).

The other likely locations of crossing points of the wall are the forts which line it. The presence of troops at these locations would have provided the opportunity to inspect goods, collect duties and monitor movement. Gates were detected on the wall side of Fort 4 (FORT_8) through geophysical survey; this gate was linked by a central road to a gate on the opposite side of the fort (Sauer et al. 2013 p.184). It is debatable, however, whether public access would be permitted through the fort, and if anyone other than the soldiers occupying the structure would have passed through. Crossing points in the wall could also have been located near forts. Two possibilities stand out for the location of such features. One is at the site of Qizlar Qal'eh (GWS_50), a multiperiod site that was reused and incorporated into the defences associated with the Gorgan Wall during the Sasanian period (Kiani 1982b Fig. 8a; Wilkinson et al. 2013 p.232)(Fig. 7-28, 7-29).

The most obvious location for a possible gate, however, is the closely spaced Forts 12 and 13 (FORT_15 and FORT_16) (Fig. 7-29). With only c. 200 m separating them, they create an ideal corridor for monitoring traffic crossing the wall. Fort 12 (FORT_15) appears to contain barrack blocks like many of the Forts along the wall (see Sauer et al. 2013 p.232; Sauer et al. forthcoming). Fort 13 (FORT_16), however, differs in its internal morphology and topographical features are present including, in the northwest corner, a much older tappeh. Low archaeological mounds north and immediately south of Fort 13 (FORT_16) may also be part of an earlier site complex. Architectural differences, noted in excavations of the Fort 13 (FORT_16) by M.Y. Kiani (that is brick alignment and wall thickness) may suggest a different or supplementary purpose for this structure (Kiani 1982b p.17, 43; Sauer et al. 2013 p.174). However, as many of the forts have not been excavated we lack a sufficient comparative sample to draw too many conclusions.

Maps based on aerial photographs and historical CORONA satellite imagery were examined both north and south of Forts 12 and 13 (FORT_15 and FORT_16) for evidence of ancient tracks, or hollow ways, leading toward or beyond these forts (see Fig. 7-30). The maps of M.Y. Kiani (1982b), themselves based on aerial photographs, seemed to indicate several routes or tracks in this vicinity. Many of these correlated to modern roads and tracks, also visible on the CORONA images, that led toward or away from the modern city of Gonbad-e Kabus. Besides being oriented on the modern city, these features also appear to dictate modern field boundaries. These are in contrast, both in signature and alignment, to a series of dark hollow way-like features c. 10-20m wide, similar in signature to those found extending from many sites in the eastern dry-farming zone north of the Gorgan Wall (Chapter 6.2.3). As argued in chapter 6.2.3, there appear to have been two phases of hollow way formation in the eastern dry-farming zone; one is likely associated with a Late Iron Age through Parthian horizon (though settlement into the Early Sasanian period cannot yet be ruled out at some sites – see Chapter 7.4.5.3 below), while another is likely associated with an Islamic horizon. Those in the vicinity of Forts 12 and 13 (FORT_15 and FORT_16) are equally interesting. Different alignments and visible stratigraphic relationships between some of the hollow ways suggest that not all of these features were in use at one time. Several groupings can be commented on.

1. A curving dark linear depression is also obvious leading from/to the west side of Fort 13 (FORT_16) and might be related to occupation at the gate or the earlier site on this location. No relationship between this and other hollow ways can be established (1 on Fig. 7-30).
2. Two faint hollow ways run southwest to northeast roughly toward the gates but fade out between 800m to one kilometre before reaching them. These are cut by (3) (2 on Fig. 7-30).

3. This group appears to branch out from a point along the possible outer wall of the ruins of the town of Jurjan (KH_138), an important Islamic period centre; this site is also a possible candidate for the Sasanian capital of the same name, though no trace of an earlier city at this site have yet been found (Kiani 1984; Sauer et al. 2013 p.360). Two of these tracks lead towards Fort 13 (FORT_16). All appear to fade out between c. one km and 600m before the wall. It can be assumed that these features are likely contemporary with occupation at Jurjan (3 on Fig. 7-30).
4. Another two hollow ways run from Jurjan (KH_138) toward the wall west of the forts. Before meeting the wall one of these hollow ways is joined by two other tracks coming from an unknown point to the south and together they appear to traverse the wall ditch. As there would be little reason for these tracks to converge if the wall or ditch, even in a ruined state, did not pose some sort of obstacle, these tracks must be contemporary or later than the wall. No clear stratigraphic relationship can be established between this hollow way and the wall ditch on the CORONA image, although it does appear to continue beyond the wall to the north. However, the location where the hollow way meets the wall seems an unlikely candidate for a crossing point while the wall was in use because of the lack of other features in the area (4 on Fig. 7-30)

While this appears to have been a high traffic area in the past, it is difficult to say whether any of this activity was associated with the active period of the wall. Indeed, due to the spatial relationship with Jurjan (KH_138), and the Early – Middle Islamic period activity noted previously in the eastern dry-farming zone, it is possible that some of these features are associated with this period of activity. As such, in order to reconstruct possible Sasanian route-ways, we must instead widen our view to take into consideration the broader mid to late Sasanian settlement pattern.

As discussed in section 7.4.3, the eastern Gorgan Plain between the Gorgan Wall/River and the Alborz Mountains was the most densely occupied sub-zone of the plain in the Sasanian period according to the currently available settlement data. Furthermore, the nature of the settlement in this sub-zone is also telling. Roughly contemporary mid to late Sasanian period sites, located south and south east of Forts 12 and 13 (FORT_15 and FORT_16), include Qal‘eh Gug A (GWS_33), Qal‘eh-ye Pol Gonbad (GWS_37), and Dasht Qal‘eh (GWS_54) form an intriguing alignment of possible gates, fortifications, and an urban centre (Fig. 7-31). Furthermore, continuing to follow the trajectory of this alignment to the south leads to the entrance of one of the most easily traversed passages across the Alborz Mountains that connects the Gorgan Plain to the Great Khorasan Road that ran from Mesopotamia to Central Asia (Le Strange 1905 p.9, Maps; Marvin 1881 Map 2). Writing in the 19th century AD Napier states:

> "In the whole range of the Alburz from Teheran to the Herat River, there is no point at which the chain could be so readily crossed by either road or railroad as on the line of the Nowdeh Valley….There is no other line offering anything like similar facilities" (Napier and Ahmad 1876 p.111).

Abbasi (2011 Map 13) also notes the presence of a Sasanian period site several kilometres into the pass (from the direction of the plain) (Fig. 7-31). No evidence is currently available on the ceramics from the site, but it presents an intriguing possibility for another node in this route system. Taken together, the archaeological data draws a convincing picture of an inter-regional route system at an imperial-scale connecting the Iranian plateau, the Gorgan Plain and perhaps the regions north of it.

If a route along this trajectory existed, Dasht Qal'eh (GWS_54), the likely Sasanian period capital on the plain, would therefore have sat in a strategic position for communicating with the plateau to the south and the steppes to the north. People and goods coming from the north could be monitored and taxed, and one or both of the large fortifications to the south could have provided further security. Equally, if we assume that Qal'eh Gug A (GWS_33) and Qal'eh Pol-Gonbad (GWS_37) were bases for campaigns against the Hephthalites then their location on a main route north would make strategic sense. Taken together, the archaeological data draws a convincing picture of an inter-regional route system at an imperial-scale connecting the Iranian plateau, the Gorgan Plain and perhaps the regions north of it (Fig. 7-31).

The level of investment in this route system beyond the wall in the Sasanian period is not currently known. Evidence for investment in regions north of the Gorgan Wall, such as in Dehistan is sparse, and regions beyond, such as Khwarezm, may have been comfortably beyond the bounds of the Sasanian Empire most of the time. Textual sources suggest that Sasanian, or more aptly imperial, influence in these regions (either direct or indirect) may have waxed and waned through time based on economic benefits and military threats (Bivar 1983 p.210–215; Frye 1983 p.129; Helms et al. 2005; Lecomte 1999 p.145–147;

Lecomte 2007 p.306–307; Nerazik and Bulgakov 1996 p.208–209). Ceramics from excavations on the Gorgan Plain and those from survey and excavations of sites in the Misrian Plain (Dehistan), c. 100 km north of the Gorgan Wall, suggest similarities in forms between the two regions, and possibly with Khwarezm throughout the Sasanian period (Lecomte and Boucharlat 1987 p.113, 119; Lecomte 1999 p.162; Lecomte 2007 p.304; Priestman 2013 p.529–530). Data on the periodization of the majority of the sites in Misrian within the Sasanian period is not available, but some material comparable to the mid to late Sasanian assemblages of the Gorgan Plain contemporary with or subsequent to the wall has been noted in material from the sites of Ortadepeslik and Khanly Depe (Priestman 2013 p.529–530). Furthermore, a Sasanian administrative seal has been found identical to one from Tureng Tappeh (Lecomte 2007 p.307). The strength of these networks, however, may be found in the longevity of this connectivity (dating back to the Iron Age) (see Cleuziou 1985 p.175–179; Lecomte 1999 p.138; Priestman 2013 p.512–520) as opposed to consistent imperial involvement. Though at times, it would have made strategic sense for the Sasanian Empire to invest in Dehistan, and perhaps by extension stations along the route towards it from the South.

Settlement data from archaeological survey indicates that there was little settlement immediately north of the wall that can be obviously attributed to the mid to late Sasanian period (Wilkinson et al. 2013 p.103) (Chapter 7.4). No clear evidence for a road or hollow way leading from our proposed gate can be seen on the CORONA imagery. However, beyond the core settled area tracks would not be confined to set paths through cultivated fields and the flat topography would not have limited movement to particular corridors. Itineraries in Islamic sources from the 13th and 14th centuries AD suggest a route connecting Jurjan and Dehistan (Le Strange 1905; al Muqaddasi 2001), and the hollow way features discussed above, radiating out from the Jurjan appear to complement this picture. Further remote sensing of the satellite imagery farther north may reveal features associated with routes through this region such as stations, cisterns, and wells as documented in early travellers' accounts (Marvin 1881 p.38; Vambery 1864 p.83). Such features have been located through remote sensing (Thomas and Kidd 2017), and ground-based survey (Williams and Wordsworth 2009) in other regions. Cursory examination of the limited survey data and CORONA imagery already suggests intriguing possibilities for nodes in this network south of the Atrak River (Kiani 1982b, Fig. 30-31; Morgan et al. 1894). However, only future fieldwork can help us to date these features with accuracy.

Further to the west, it is also possible that south-north routes existed. The road leading out of Qal'eh Kharabeh (GWS_1), toward the north for instance, while not traceable for any considerable distance may have lead toward the wall, or a crossing point along it (GWS_50 for instance – see above). Furthermore, possible Sasanian period occupation at or in the modern city of Gorgan (Abbasi 2011; Kiani 1982b), may represent a second urban centre or town within the plain. The site, known as Astarabad in historical sources, was at the least an important town by the 10th century AD (Le Strange 1905 p.378–379). Crossing the Alborz near this location led to the plain of Damghan, itself an important location on east-west routes through the region indicated in Early Islamic sources; while no records of this route survive from the Sasanian period, the settlement pattern in the Damghan Plain during the late Sasanian period, in which it appears to indicate that control of the river valley flowing into the Damghan plain was important (Trinkaus 1983).

7.4.5.2 EAST-WEST ROUTES AND THE CASPIAN SEA

The wall may also have formed an important corridor for east-west movement within the plain. While the wall was being constructed, it is possible that construction materials may have been transported by boat along the wall ditch. The depth of the ditch would have allowed for such a prospect (Sauer et al. 2013 p.168) and it is conceivable that such as system of transport was still in use after the wall was constructed. A land route running parallel to, and behind the wall may have been a more secure way of moving people and goods along this corridor. Interestingly, the line of the wall long after its abandonment was one of the best ways to travel across the plain from east to west, avoiding boggy ground. Vambery (1864 p.78) observed:

> "The morasses are caused by the inundations of the Gurghen, which swells in spring and often overflows its banks for miles and miles. This must have been the case in ancient times, for it was considered advisable to build the great wall before mentioned as a defense, at a distance of from four to six English miles from the north bank of the river; and as this was always on one of the highest parts which could be found in the plain, the parts adjoining the wall, now in ruins, constitute at the present day the safest route in all seasons of the year".

Possible traces of what might be hollow ways were noted at three locations on the CORONA images south of Forts 4 (FORT_8), 9 (FORT_13) and 10 (FORT_14) (in the eastern part of the plain; it has been speculated that "these features could represent a single route that followed to the south of the wall, not parallel to it, but following a sinuous path varying from within on hundred metres south of the wall to as much as 1 km to the south", though may also represent more modern tracks or even canals (Wilkinson et al. 2013 p.68). The mapping of non-modern routes within the vicinity of the Gorgan Wall has also revealed several further anomalies that may supplement this picture. The linear anomaly to the south east of Fort 4 (FORT_8), can be traced a further c. 2 km to the east, again following the line of the wall, though it is obscured in several places by a modern track on the same alignment. Furthermore, in the western part of the plain, canal like features running parallel to the wall to the south of GWS_50 toward GWS_4 may also represent such a route (see section 7.4.2). However, the formation of hollow ways occurs primarily in areas where movement is restricted by enclosed fields. If, as proposed, there was little to no agricultural investment along the wall corridor, at least by the mid to late Sasanian period, then it is possible that hollow ways will not have formed. Despite this, one might expect frequent foot traffic at a wall crossing point to have resulted in a well-worn path in the vicinity of the gate. The lack of one may reflect among other things differences in the volume of traffic, the frequency of movement, or the length of time such a route was in use.

Further south in the plain, particularly in the core settled areas, east-west routes must also have existed, connecting not only local communities, but potentially linking the Gorgan Plain to other parts of the Sasanian Empire through Gilan and Mazandaran, or via the Caspian Sea. Quantities of goods, such as Sasanian silver found on the western shores of the Caspian, but likely originating from the eastern shores attests to the possibility of such trade (Frye 1972 p.267). Equally, bitumen found in excavations at Fort 4 (FORT_8) suggest that such commodities may have been brought from sources along both coasts of the Caspian Sea (Sauer et al. 2013 p.191). Naphtha, as well as salt, continued to be a key commodity traded by the Turkmen groups inhabiting the regions north of the Gorgan and Atrak Rivers in the 19th century AD (Fraser 1826 p.15; Muraviev 1871 p.19–20; Napier and Ahmad 1876 p.115–117; Vambery 1864 p.57), and trade between coastal towns along the Caspian is suggested in the Early Islamic period (Ibn Hawqal 1800 p.184) Because most of the sources are along the coast, it is likely that it may have been transported by sea, but this does not preclude another impetus for northern trade routes as well. Very little evidence for Caspian Sea trade exists for the Sasanian period. Abaskun, the medieval port for Gurgan and Astarabad may have been originally been constructed in the Sasanian period under Kavad; however, the site is said to have been engulfed by the Caspian Sea, likely in the 14th century AD and its location is unknown (Le Strange 1905 p.379). Though as it was said to be located near the mouth of the Gorgan River, it might correlate to the site of Gomish Tappeh or its environs (Huntington 1907 p.585; Sauer et al. 2013 p.153).

7.4.5.3 LOCAL PATHWAYS OF MOVEMENT AND REGIONAL CONNECTIVITY: A DIACHRONIC VIEW

The available evidence can also be used to elaborate on local pathways of movement and suggest ways in which networks may have changed though time. Evidence for local networks prior to the construction of the Gorgan Wall can be found in abundance to the north of the Gorgan River in the eastern end of the plain in the form of the well-preserved hollow way systems discussed in chapter 6. These hollow ways represent local networks through which people and animals could travel to fields, water sources (such as the Gorgan River) or perhaps to pastures beyond the limits of cultivation around a site. Equally, some can be seen to represent a regional network facilitating movement between sites and across the plain.

These networks appear to have no longer been in use by the time the Gorgan Wall was built. [33]Hollow ways radiating out from the site of GWS-25 in the eastern steppe north of the Gorgan River, for example, are clearly cut by the Gorgan Wall ditch (see Fig. 7-32). GWS-25, and its neighbouring sites such as GWS-26 and GWS-27 were likely occupied at the same time at some point between the Late Iron Age and Parthian periods, after which the latter two (and by extension the use of these routes) were abandoned. At GWS-25, however, there is possible evidence for Early Sasanian occupation, suggesting that some of these pathways of movement may have continued to be used (Wilkinson et al. 2013 p.119). As such, the pattern of settlement characteristic of the mid to late Sasanian period, in which almost all occupation is concentrated in the southern part of the plain, may have been a gradual process. We know that by the 4th century AD, Sasanian emperors were already campaigning against nomadic groups north of the Gorgan Plain (Bivar 1983 p.211; Litvinsky 1996 p.138) and this threat could have been a contributing factor in formalising the Sasanian settlement pattern that is solidified after the wall was built. Clearly the

[33] While it is not inconceivable that the wall terminated the use of the particular hollow ways in the vicinity of GWS-25, GWS-26 and GWS-27, the majority of sites in the eastern dry-farming do not have ceramics that reflect Early Sasanian occupation. However, only further survey and ceramic analysis can clearify this.

construction of the wall would have altered connectivity on the plain by cutting across local routes that may have been in use for several centuries prior to this.

As our understanding of the Early Sasanian period on the Gorgan Plain is sketchy at best, it is difficult to say whether any kind of formal military frontier existed, and how it affected movement on a regional scale. However, the alignment of fortified sites arrayed along the Stage 3 palaeochannel of the Gorgan River discussed in section 7.4.1 may represent an earlier type of frontier. However, while the River formed an obstacle, this system may have been more permeable, like the *Limes Arabicus* of the Roman/Byzantine Empire; this system would allow for tabs to be kept on seasonal movements of mobile pastoral groups, but would not exclude trade or the daily movement of herds (Fisher 2004; Mayerson 1986 p.71; 1989)[34]. It is also difficult to say, without further chronological refinement, at what level movement through the Gorgan Wall was regulated from the period of its construction through to the end of the Sasanian period. Periods of more cordial political relations with the Hephthalites or the need to send troops elsewhere could have reduced the number of persons active along the wall (Sauer et al. 2013 p.214–15) though crossing points may still have been used to collect tolls on goods moving into and out of the empire.

What is clear, however, is that while the wall was actively in use from the 5th/6th to 7th centuries AD, small and medium scale movement on a regular basis would likely have been restricted to the southern half of the plain. The wall would have constituted a considerable barrier to movement at all but a few tightly controlled crossings, making daily movements toward the northern part of the plain, perhaps in search of pasture, less likely. However, the exploitation of various herd animals is clear in the faunal remains recovered from mid to late Sasanian sites on the plain, suggesting that alternative patterns of local movement must have developed while the wall was in use (Mashkour 2013; Mashkour in press). Perhaps, the gap in settlement (and possibly cultivation) between the core settlement zone and the wall corridor may have provided much needed grazing land. By way of comparison, Alizadeh (2011 p.75) suggests that the settlement of mobile groups in the Mughan Steppe area may have been one resource for the populations that appear in the region alongside

[34] Lecomte (Lecomte 2009 p.301, 310–11) believing the Gorgan Wall to originally be a Parthian construction, reused in the Sasanian period, has suggested a limes style second line of defence existed behind the wall within the plain. While the dating of the wall has now been confirmed as Sasanian, it is possible that a limes style arrangement may have predated the wall, or indeed existed behind it.

substantial fortified sites/farms and irrigation systems in the Sasanian period; at the very least, he suggests that the imposition of this system of the landscape would have reshaped the way in which mobile pastoral communities moved around the region.

7.4.6 THE ISLAMIC PERIOD – CONTEXTUALISING THE SASANIAN SETTLEMENT PATTERN

In this and the previous chapter I have mentioned site morphologies, routes, and irrigation systems likely associated with the Islamic period. At this point, I wish to briefly summarise this evidence. This is to provide context for the preceeding discussions of the landscape signatures of both the Iron Age through Parthian, and Sasanian periods.

The Islamic period encompasses a considerable span of time, but in most cases, the survey data is not chronologically specific enough for us to discuss settlement patterns by sub-period. More temporally specific information can be gleaned from the textual sources. This was for example, considered in terms of what it could tell us about historical land use in the region in chapter 5.2.2. However, an analysis of these texts could occupy an entire thesis in itself. Here, I only wish to undertake a brief consideration of the settlement data available for Islamic period occupation.

It seems likely, that the peak in settlement density in the Islamic period occurred prior to the Mongol invasions. Historical accounts, mentioned in Chapter 5.2.2 speak of the prosperity of Jurjan and the surrounding countryside in the 10th century AD (Le Strange 1905 p.377–379; Muqaddasi 2001 p.290–91; Ibn Hawqal 1800 p.179–180). However, even in the period after the invasions by the Mongols, and then by Timur and his armies, Jurjan does not appear to ever had built itself back up to its former socio-economic and cultural status (Le Strange 1905 p.376–378). Following the Safavid period (later 18th century) the settlement pattern shifted significantly again. In fact, through to the early 20th century, sedentary settlement was pushed even farther south than in had been in the Sasanian period and the landscapes north of the piedmont zone were the domain of the Turkmen tribes (Chapter 5.2.2).

There is a significant increase in the number of sites assigned to the Islamic period as compared to the Sasanian period in the Abbasi (2011) dataset; however as previously noted, we do not know how this data breaks down by sub-period. As such, it is difficult to comment on the differences between mid to late Sasanian period settlement pattern and the Early Islamic settlement pattern. Equally, in the Shiomi (1976, 1978) and Arne (1945) datasets, where Islamic material is identified there is no indication of more temporally specific occupation; however, it is likely that these identifications were made on the basis of the presence of glazed wares (see Chapter 5.2.3.1). Kiani (1983) also identified a significant number of sites with Islamic material. In some cases, he also gives more chronologically specific information. However, this is mainly for sites along the Gorgan Wall corridor, and large geometric sites elsewhere in the plain. As such, this information is geographically limited.

In terms of site distribution, the *GWS* results suggested to Wilkinson et al. (2013 p. 99) that the majority of Islamic period activity was concentrated to the south of the Gorgan Wall. Indeed, the highest density of settlement for Islamic sites from all survey datasets is still along the piedmont plains, as in the preceeding Sasanian period (Fig. 7-26). The core settlement zone in the eastern end of the plain (see chapter 7.4.3) continues to be the most densely settled part of the plain.

Occupation of the zone between the piedmont plains and the Gorgan River, as well as the more northerly steppe margins was notably absent (or much reduced) in the mid to late Sasanian period (Fig. 7-22). However, at some point in the Islamic period some infilling of the landscapes between the piedmont plain zone and the steppe margins occurred (though it never reaches the density visible in the piedmont plains).

No survey appears to have been conducted by Abbasi (2011) to the north of the Gorgan Wall in the western steppe (Fig. 1-40). Several sites with Islamic period occupation were noted in the in the *GWS* and other datasets in the western steppe (see Fig. 5-12 for example). Based on these data, settlement density is very low in this zone in the Islamic period. On the other hand, there appears to have been significant Islamic period activity in the eastern dry-farming zone, possibly peaking in the Middle Islamic period. The evidence for this was reviewed in the discussion of hollow way systems in Chapter 6.2.3 and 6.4.2.2. Interestingly, Islamic period occupation is concentrated in the westernmost area of the eastern dry-farming zone. This may be linked to both the economic opportunity and security provided by its proximity to the Islamic period capital of Jurjan and the more favourable climatic conditions.

It is likely that qanat irrigation was employed in the piedmont zone (Chapter 7.4.4). North of this zone settlements appear to be closely tied to river and stream courses. As detailed in Chapter 6.2.1.1 and Table 6-8, the course of the Gorgan River changed multiple times in the western steppe. One of these shifts may have occurred sometime during or after the Ilkhanid period (c. 13th-14th centuries), after which the river may have flowed along both the Stage 3 course, and more or less along its current course. Some evidence for Islamic period irrigation between the river and the vicinity of the Gorgan Wall was outlined in section 7.4.2 of this chapter.

In sum, more work needs to be done in producing a more chronologically refined understanding of Islamic period settlement on the plain. In any case, it appears that after the Gorgan Wall fell out of use, settlement resumed in the steppe margins, through potentially not on the same scale as in the early Late Iron Age through Parthian periods. However, in the eastern steppe at least, the pattern of settlement and land use (resulting in the formation of hollow ways), forms a similar signature landscape to that of the Late Iron Age through to Parthian period, though the socio-cultural mechanisms behind it may have been very different. This is in stark contrast to Sasanian period settlement and land use in the steppe zones.

7.5 DISCUSSION

The distribution of Sasanian settlement across the plain appears to be related to both water resources, and defence. The majority of sites are located to the south of the Gorgan River in zones that can be dry farmed (in excess of 400 mm per annum), this is immediately north of the Alborz foothills up to the northern edges of the alluvial fans radiating out from the mountains - a strip with a width of c. 20 km (Chapter 7.4.3). Sites are also focused, though in fewer numbers, within a relatively narrow corridor, between the Gorgan Wall and the banks of the Gorgan River (Chapter 7.4.1). A significant gap in sites attributed to the Sasanian period between these two zones is apparent in the western and central parts of the plain, while at the eastern end of the plain, this gap is nearly non-existent due to the decreased distance between the Alborz Mountains and the Gorgan River. However, because the ceramics of the mid to late Sasanian period are the best known, the observable pattern of site distribution we are calling 'Sasanian', may in fact be skewed in favour of the phase contemporary with the construction and use of the wall. Furthermore, while we may be faced with an incomplete settlement record or issues with the ceramic chronology, this pattern is supported by the distribution of extramural settlements around the forts lining the Gorgan Wall, and the proximity of known Sasanian period sites of a primarily defensive nature along the wall corridor in the western steppe confirmed by the *GWS* (Chapter 7.3.3.3 and 7.41)

Limited Sasanian period activity is attested to the north of the Gorgan Wall, and may be restricted to a small number of multiperiod sites with evidence for Early Sasanian activity. However, even this activity appears to have been on a relatively small scale. It could be speculated that any traces of military or economic activity north of the Gorgan Wall in the eastern dry-farming zone at least, may have been related to the proposed route system discussed in chapter 7.4.5. We have suggested that the lack of Sasanian investment in the landscape to the north of the Gorgan River/Wall may have been a consequence of political factors as opposed to limitations of the natural environment (Shumilovskikh et al. 2016; Wilkinson et al. 2013 p.100). Wet conditions persisted during the Parthian and Sasanian periods (Shumilovskikh et al. 2016) ruling out a drying event, or desertification (e.g. Barker 2002) that may have contributed to settlement retracting back toward the better watered foothills of the Alborz. In periods in which the threat of raids or invasions from the north were high, particularly prior to the construction of the Gorgan Wall, the safest locations for sedentary settlement would have been near the Alborz foothills. A defensive system perhaps consisting of a line of fortified sites exploiting the natural boundary created by the Gorgan River may have existed prior to the construction of the Gorgan Wall, perhaps at least by the 4th century AD or may also have been used as a secondary line of defence after the construction of the wall (Wilkinson et al. 2013 p.100–102) (Chapter 7.4.1). Significant investment in agriculture to the north of the Gorgan River, or even immediately to the south of it, may have been expensive and risky. In the 19th century AD, the constant threat of Turkmen raids and the prospect of being sold into slavery restricted sedentary villages to within a few kilometres of the Alborz foothills (see section 5.2.2). While an anachronistic political and social situation, the response to threat may have been similar. However, further intensive survey, and a better understanding of Early Sasanian ceramics may provide us with a wider distribution of settlement in this sub-period.

The gap between the wall/river corridor and the piedmont plains may also be representative of the mid to late Sasanian settlement pattern. There is clear evidence for large-scale water systems employed for construction, defence and everyday usage in the vicinity of the wall, but there is minimal evidence for the use of these particular systems in irrigating fields (Chapter 7.4.2). Indeed, the settlement data seems to suggest, overall, that by the time the wall was constructed in the late 5th or early 6th century AD, there was little Sasanian activity to the north of the wall and limited non-military activity in the wall corridor evidenced in the *GWS* dataset. Though there may have been settlements that formed around some of the forts, or a few sites in the immediate vicinity of the Gorgan River that may have been engaged in agricultural activities. This raises several questions. Why maintain this buffer zone even after the wall's construction? Howard-Johnston (2012 p.104), for instance, has suggested that the Gorgan Plain, fortified to the north by the Gorgan Wall, to the west by the Tammishe Wall and the Caspian Sea, and to the east and south by the Alborz Mountains formed a sort of arena of war; once entered (by breaking through the Gorgan Wall) invading armies could be contained. However, in the eastern end of the plain, the gap between the Gorgan Wall/River and settlement is non-existent. Perhaps to compensate for this, though, there is a high concentration of large geometric enclosures (campaign bases and forts – i.e. Qal'eh Pol Gonbad (GWS_37), Qal'eh Gug A (GWS_37), Gabri Qal'eh (GWS_49)), as well as the Sasanian urban centre of Dasht Qal'eh (GWS_54), itself also fortified. As such, while no buffer zone existed at this end of the plain, security was enhanced by these fortified structures.

It is difficult to comment on the significance of the distribution of the large square fortified enclosures without further chronological refinement, though (Chapter 7.3.3.2). While their size indicates they likely housed a considerable number of people, it is likely that they were not all in use at the same time. They may represent discrete phases of military activity after which they were not maintained. It may have therefore been easier to construct a new base for a new campaign than to renovate an older structure. However, it is also possible then when not in use, they could have been used for storage of goods stockpiled for periods of intensified military presence. The presence of two such structures near the proposed Sasanian route system in the eastern end of the plain may suggest that this route was used for northern excursions on and off over the course of several centuries (Chapter 7.4.5). Interestingly though, as Fig. 7-22, illustrates, there are a number of large geometric enclosures sitting along the northern edge of the piedmont plains. If temporary campaign bases, they could be easily supplied by the fertile agricultural lands to the south.

How does the above information square with our understanding of urban and rural population in this period? The staggering increase in the size of the largest site in this period, i.e. Dasht Qal'eh (GWS_54), suggests substantial urban growth, but a corresponding decrease in the number of smaller sites suggests that it was at the expense of rural populations. The apparent decrease in rural settlement could be seen from two perspectives. If we see the Gorgan Plain as a strategic military zone, but too unstable to produce the surplus needed for supporting a large population, then supplies could have been brought from neighbouring regions. Occupation of the forts along the wall, and associated extramural settlement may have buoyed the non-urban population, but again, would require support from an agricultural base unless the occupants of the forts were also engaged in cultivation. Furthermore, we must also factor in considerable (possibly temporary) increases in population when a large number of troops may have been stationed within the so-called campaign bases. Although, this impact may have been less than expected if we surmise that these bases are likely not contemporary and represent discrete phases of increased military activity. The massive labour force required for the construction of the Gorgan Wall, and maintenance of the large canal systems associated with it may have been partly supplied by the permanent or temporary military forces along the wall.

If, however, we do not view a decrease in rural settlement as evidence for lack of intensive production another option presents itself. The location of Dasht Qal'eh (GWS_54) in the core long-term settlement zone of the plain may have allowed for the concentration of population within an area of agricultural intensification, while at the same time freeing up land for cultivation. Furthermore, we must factor in the possibility of the founding of low-level small settlements that are currently difficult to detect. This would square with the increased human impact on the landscape, noted in the Kongor Core in the later Sasanian period (Shumilovskikh et al. 2016 p.14). This may suggest that agricultural intensification, including some form of irrigation was undertaken. Furthermore, the location of a number of the large geometric fortified sites along the northern edge of the piedmont plains reinforces the theory that agricultural production was concentrated within the piedmont zone.

Indeed, while evidence for canals on the scale seen to the north of the Gorgan River in earlier periods, or in associated with the Gorgan Wall has not been located in the southern part of the plain, this does not mean that these regions were not being intensively exploited. The piedmont plains between the Alborz foothills and the edge of the alluvial fans are by far the most agriculturally productive portion of the plain and considerable yields are possible with dry farming. However, modern statistics indicate that yields of cotton, for instance are two and a half times greater with the aid of irrigation (Okazaki 1968 p.22). This, of course, assumes modern techniques, and by extension higher yields, but it could be presumed even with less intensive irrigation techniques that output could be improved considerably. This simply may suggest irrigation systems of a smaller scale, perhaps taking water off the main streams extending down from the Alborz. While not dated, a few examples of such canals are visible on the imagery extending perpendicular to the streams. Of course, it is possible that qanat irrigation may have played a role (Chapter 7.4.4). However, investement in irrigation systems, particularly in the form of canal irrigation was an integral part of the Sasanian landscape signature in both core and peripheral regions of the empire including Khuzestan and the Mughan Steppe (e.g. Adams 1962; Alizadeh and Ur 2011) (see also Chapter 8.2.3)

The populations of the plain, instead of investing in higher-risk agriculture in the vicinity of the Gorgan Wall, may therefore have engaged in the intensification of agriculture in the wetter piedmont plains farther south. The risk, in the case of the landscapes to the north of the Gorgan River, would be both economic and military. Significant investment would be required to produce substantial yields, due to the lower capacity of the natural environment (climate, water availability). This economic risk, not to mention the risk to the personal safety of the communities living in this landscape, is increased by danger of raids and invasions from the north.

It has been suggested that reforms to taxation in the later Sasanian period might "have been to make the revenue of the Empire more predictable and thus to help planning long-term redistribution. That the Empire had growing needs for this can be linked with the military reorganization which also took place in late Sasanian times" (Christensen 1993 p.38–39). The security provided by not only the Gorgan Wall, but also the Tammishe Wall (protecting the wall from approach from the west) (Sauer et al. 2013), would have helped to secure this fertile region. Such a process of intensification would have required a substantial labour force and would suggest an increase in population. While the plain has been demonstrated to have been densely populated from the Late Iron Age onwards, additional population increases may have been achieved through state-sponsored deportations to the region or the settlement of mobile pastoral populations as suggested for other regions (Alizadeh 2014a p.106–107), though we lack written evidence for such events for the Gorgan region.

7.5.1 THE GORGAN PLAIN IN THE MID TO LATE SASANIAN PERIOD – AN IMPERIAL (MILITARISED) LANDSCAPE

The construction of the Gorgan Wall indicates a clear transformation of the landscape and a solidification of its role as a frontier region. It is clear that a top-down investment in military infrastructure occurs in the mid to late Sasanian period, but was this accompanied by a directed reorganisation of the rural landscape as part of a frontier strategy? That the Gorgan Plain could be a highly productive region is evidenced in the historical sources and the palaeobotanical record. Unfortunately, we lack written evidence regarding cultivation for the Gorgan region during the Sasanian period. Staple crops of Sasanian Iran, overall appear to have been wheat and barley (Bulliet 2009 p.12) Cerealia-type indicators in the pollen core from Kongor show slight increases from c. 2.6 ka; miliacin (a molecular compound indicator for broomcorn millet) is present from that period until 0.8 ka, suggesting cereal crops were being cultivated on the plain prior to and throughout the Sasanian period. This is accompanied by evidence during the same time-frame for cultivated tree species including grape, walnut, chestnut, white mulberry and plane tree (Shumilovskikh et al. 2016 p.13). The palaeobotanical evidence from excavated Sasanian contexts is limited to charcoal samples, but these also indicate the presence of walnut and plane trees (Poole and Gale 2013). Most silk from Sasanian contexts appears to have been imported from China, and little evidence currently exists for its production, even though later on Iran would become a key producer (Bulliet 2009 p.13). The presence of white mulberry in the Kongor core is interesting, particularly as part of the package of cultivated trees that appears sometime between the 8th century BC and the 13th century AD (Shumilovskikh et al. 2016 p.9). However, without further chronological refinement its presence could be a post-Sasanian appearance. Evidence for cotton has been found in Sasanian contexts at Merv (Simpson 2014 p.15), though some scholars have argued that its commercial production in Iran, particularly on the Central Plateau, would have occurred with the Arab conquest where underdeveloped land was brought under cultivation through the use of qanats (Bulliet 2009 p.8). Cotton, however, had been cultivated for millennia prior to this in South Asia; evidence for its exploitation has been found at Mehrgarh (Fuller 2006 p. 27). No evidence for cotton has yet been found for the Sasanian period in Gorgan, but the conditions, particularly if irrigation was being employed in the southern part of the plain would have supported its production.

The overall settlement data appears to suggest that at a broad level, population levels remained high in the Gorgan Plain following on from the Iron III period through to at least sometime in the Parthian period (Abbasi 2011; Kiani 1982b; Wilkinson et al. 2013) (Chapter 6.2). We currently have a poor understanding of Early Sasanian settlement and land use, in comparison to the somewhat better known mid to late Sasanian horizon. The archaeological evidence allows for the possibility of continued settlement in the steppe margins in the Early Sasanian period, though perhaps on a diminished scale. This may indicate a gradual abandonment of the steppe zone, though only further detailed ceramic studies, and excavation, can help us understand the finer details. We know however that starting from the 4th century AD nomadic polities were threatening the frontiers of the Sasanian Empire. The possibility of the development of a *limes* style frontier zone perhaps akin to the *Limes Arabicus* on the eastern Roman frontier (Banning 1986; 1987; Fisher 2004; Mayerson 1986; 1989; Parker 2006) involving fortified sites, settlement and/or natural features like the Gorgan River may have existed in the Early Sasanian period (Chapter 7.4.1). Certainly, though, by sometime in the 5th or early 6th century AD, the military frontier was formalised by the construction of the Gorgan Wall, after which there is little or no evidence for settlement in the arid margins. Frontiers, however, though often portrayed as such, are not simplistic linear boundaries; instead they frequently comprise multiple, and often overlapping, military, cultural or economic boundaries that can range along a continuum between physical barriers and conceptual boundaries (Elton 1996; Glatz and Matthews 2005; Lattimore 1951; Parker 2002; Smith 2005) (see discussion in chapter 2.2). The possibility of Sasanian period activity in the Misrian Plain (perhaps periodic) (Lecomte 1999; 2007), and investment in a route system to the north of the wall suggests that this barrier was only one element of this frontier. Economic and cultural connectivity may have extended this frontier zone much farther to the north than the obvious military frontier (Chapter 7.4.5). These proposed stages in frontier development during the Sasanian period should be tested through further refinement of the Sasanian ceramic sequence from excavtions, and intensive survey, particularly within the arid margins and the wall Gorgan Wall/Gorgan River corridor.

The most notable feature of the known Sasanian settlement pattern is the apparent decrease in the number of rural sites. This appears to be in direct contrast to the patterns of agricultural intensification that are found in the core regions of the empire and on other frontiers (Chapter 8.3.3). Indeed, the massive scale of the military infrastructure projects undertaken on the Gorgan Plain would have required a significant amount of people engaged in producing agricultural surplus (Payne 2014). Furthermore, the multi-proxy palaeoenvironmental data from the Kongor core in the eastern plain suggests a peak in human impact on the landscape sometime in the later Sasanian period, comparable only to a similar peak in the Middle Islamic period (c. AD 1000) (Shumilovskikh et al. 2016 p.13) suggesting an increase, not a decrease, in agricultural production.

The considerable increase in the size of the largest site and likely urban centre, Dasht Qal'eh (GWS_54) in the Sasanian period, may represent a trend toward centralisation, though it leaves the problem of how this urban population, or those involved in large infrastructure projects such as the Gorgan Wall would have been supported if the rural tax base was diminished. The importation of supplies to the region is possible; future research on material culture imports, and palaeobotanical studies may indicate long-distance movement of goods. On the other hand, the decrease in rural settlement might suggest that part of Dasht Qal'eh's (GWS_54) population was still engaged in agricultural production. It is also possible that what appears to be a lack of rural sites could be the result of poor knowledge of ceramics from non-military contexts, and perhaps more importantly the under-recognition of extra-mural settlement or low-relief sites (i.e. newly founded, and thus perhaps shallow because they were relatively short lived). Such settlements would be hard to trace without intensive pedestrian survey, particularly in the southern part of the plain, a 'landscape of destruction' (Wilkinson 2003). As such, any future fieldwork, should involve intensive survey which will hopefully be more successful in identifying all sites low-level relief sites and artefact scatters. This interpretation may furthermore be supported by the abandonment of several tappeh sites in the southern half of the plain sometime in or after the Parthian period as suggested by excavations at Yarim Tappeh (KH_79) and Narges Tappeh (HUS_19) (Abbasi 2011; Crawford 1963). However, if this represents a wider pattern (that is a shift in site location) is difficult to comment on with the current data.

Leaving site numbers aside, what does the distribution of known Sasanian period sites tell us? Clearly, there is little or no sedentary settlement in the steppe margins. Activity relating to a Sasanian (and more likely a mid to late Sasanian) period horizon is concentrated along the Gorgan Wall corridor (mainly to the south of it) and within the core settlement zone (along the alluvial fans) in the southern part of the plain. If we assume that the need to produce surplus to feed urban and/or military populations was important in the Sasanian period, how could this have been achieved with a smaller area under cultivation than in previous periods? The solution would be to intensify agricultural production along the alluvial fans where irrigation could be employed but was not necessary for significant yields. However, increasing production through the use of irrigation would make sense. We have little evidence for investment in large-scale canals besides those found in association with the Gorgan wall. However, irrigation could have taken the form of qanats, such as were employed in other parts of the empire and considered of great importance for irrigation (Alizadeh 2014a p.105; Daryaee 2009 p.134). Alternatively, increased yields could have been achieved by the redirection of water through the use of small-scale investments in bunds or dams, as seen on alluvial fans in South Asian contexts (Petrie and Thomas 2012). The concentration of cultivation on the alluvial fans may also have freed up significant areas for pasture between this zone, and the Gorgan River as the movement of herds to the steppe margins may have been curtailed, or even stopped, after the wall's construction. Further intensive survey is required, particularly in the zones in which we do not currently have evidence for Sasanian settlement to confirm this pattern.

In summary, the Sasanian period settlement pattern on the Gorgan Plain appears to have been characterised by the growth of a large urban centre, and a significant shift in settlement location as compared to earlier periods. Two competing models were presented. In the first, a decrease in rural site numbers was related to the growth of an urban centre, but also occurred as part of a general population decline as the result of insecurity. However, the considerable investment in military and water management infrastructure appears to contradict this. As such, a second model in which the growth of a large urban centre was accompanied by an increase in small rural sites (underrepresented in the available survey record) could be considered. In either case, the intensification of agriculture, potentially aided by qanat or small-scale canal irrigation, in the less militarily and environmentally risky piedmont plains is proposed. This would have left a relatively secure zone between the piedmont plains and the Gorgan Wall available for pasturing animals.

The evidence suggests significant differences in the relationships between urban, rural and mobile pastoral communites, as well as the relationships between state-level actors and local populations in this period as compared to the earlier Late Iron Age through Parthian horizon. The following chapter will explore these differences, and compare the signature landscapes described in chapters 6 and 7 to other parts of the greater Near East where significant landscape transformations occurred between the 1st millennium BC and the 1st millennium AD.

8 LANDSCAPE TRANSFORMATIONS FROM THE IRON AGE TO THE TERRITORIAL EMPIRES

This chapter will present a broad overview of local and regional land use and settlement through time highlighting the unique settlement histories of the various sub-zones of the plain and their potentials. This will highlight the similarities and differences between settlement patterns, evidence for agricultural and pastoral strategies, and connectivity between the case studies presented in chapters 6 and 7. It will compare the landscape signatures of these periods to patterns from other regions in which later territorial empires have had significant impact on landscape change or development. Do the actions of empires leave the biggest imprint on the landscape, or can other processes affect as much, if not more change? The purpose of this chapter is to assess the relationship between activities of the later territorial empires and the landscape signatures visible in the Gorgan Plain. It will also place these patterns within a wider temporal and geographical framework in an attempt to add to the discussion surrounding Wilkinson's (2003) concept of landscapes of dispersal.

8.1 GEOGRAPHY, ENVIRONMENT, LAND USE AND SETTLEMENT – SPATIAL VARIATIONS THROUGH TIME

In a recent publication, we presented an overview of the broad geographical-historical regions associated with settlement development on the plain based on the *GWS* survey data (Wilkinson et al. 2013 p.99–100, Fig. 3:79). Moving from north to south we have:

1. The area between the Alborz Mountains and the Gorgan River, defined as the core zone of long-term settlement in the Gorgan Plain
2. The area between the Gorgan River and the Wall that was actively in use during the Wall's lifetime.
3. The area immediately north of the river, was characterised as the steppe margins, settled sometime between the late Iron Age and the Parthian period
4. Further to the north, in the interfluve between the Gorgan and Atrak Rivers, is the zone of long-term zone of mobile pastoral activity.

This model while a useful schematic was very much influenced by the location of the Gorgan Wall. While its impact on perceptions of the landscape during and after its lifetime are arguably considerable, the Gorgan Wall should not be the frame of reference for our understanding of long-term land use and settlement – and particularly for periods prior to its construction. By using it as a point of reference, we cannot help but present a relatively static picture from a specifically 'Sasanian' perspective. However, we can now supplement this picture with information from the larger dataset discussed in this thesis and reconsider both long and medium term trends from multiple spatial and temporal perspectives, and attempt to produce a more nuanced narrative. As such, we can further recognise how the gradual increase in aridity from south to north affected settlement development, but also how these patterns present when accompanied by east-west variability in rainfall, topography, geology, and hydrology, all of which serve to create environmental sub-zones within the plain that each have their own unique history of long-term settlement (see Fig. 8.1). As such, the landscape, and its use, can be viewed, in Marfoe's words (1979 p.3), as "a vast mosaic of small, diverse, and localised microenvironments, where wide variations co-exist. Within this mosaic there can be defined a number of principal resource habitats, each gently merging with its neighbours, yet clearly distinguished by its patterning of subsistence strategies and local population groups".

Looking at the aggregate settlement data then (site number and location), it is clear that the highest settlement density through time occurs in the southern part of the plain (that is between the Alborz foothills and the Gorgan River). However, there is considerable variability in the density and extent of this 'core settlement' area through time; the recent, historical, and archaeological data suggest that there was a constant push and pull between cultivation and steppe influenced by social, political, cultural and environmental factors. The highest density of sedentary (or at least tappeh based) settlement is, in almost every period, concentrated on the alluvial fans extending from Alborz foothills. This is, of course, not surprising given the resources of this zone. Rivers and streams extending along the fans provide water for agriculture and daily use, while the alluvial soils are incredibly productive. Rainfall in this sub-zone exceeds on average 300mm per annum, with c 800 mm per annum received in the immediate shadow of the Alborz Mountains, and while seasonal variations in water availability clearly exist, considerable yields can be achieved without the aid of irrigation. Even so, these landforms support a substantial number of qanats that clearly demonstrate significant investment in irrigation during particular periods.

Within this zone, settlement density varies from east to west, and in relation to the main streams flowing down from the Alborz Mountains. The densest concentration of sites in all periods is found towards the eastern end of the plain, to the south and east of Gonbad-e Kabus. The attractiveness of this sub-zone (the eastern core settlement zone) is a consequence of the minimal distance between the Alborz Mountains and the Gorgan River, high rainfall allowing for the production of significant yields without the aid of irrigation, and potentially the proximity of one of the most important passes through the Alborz (see Chapter 7). In the Late Iron Age this is the most densely occupied area of the plain, while from at least the Sasanian period, here can be found the largest sites and potentially the urban core of the region (Abbasi 2011; Kiani 1982b; Wilkinson et al. 2013; see also Chapter 7). Living in the shadow of the Alborz would have offered other benefits as well. The forested slopes would have provided a number of resource rich areas from which products such as timber could be sourced. Furthermore, as well as providing relief for populations from the heat of the plain in the summer, vertical transhumance as evidenced in more recent times may have also been practised (see Digard and Pâpoli-Yazdi 2008 p.95–98).

At times, the northern reaches of the alluvial fans appear to demarcate the extent of sedentary settlement; this is the core settlement zone at its most limited. This appears to be the case for the mid to late Sasanian period, and for parts of the 18th through early 20th centuries AD. While clearly determined by different social, political and economic factors, and taking different forms, the retraction of settlement toward the piedmont plains and the Alborz foothills could be seen as a timeless response to threat and instability. Moving north from the alluvial fans toward the Gorgan River, overall settlement density gradually decreases as aridity increases. At times, this sub-zone was densely occupied and could be seen as an extension of the core settlement zone. Irrigation agriculture beyond the piedmont would have relied on water (via canals) from the Gorgan River and other streams as opposed to qanats. However, for example, for several hundred years between the 18th and early 20th century AD, non-intensive agriculture and mobile pastoral strategies dominated over this landscape.

North of the Gorgan River, is the zone characterised as the steppe margins. Here again, climate and topography vary from east to west creating different environmental sub-zones each with their own unique settlement history. At the eastern end of the plain one encounters what has been characterised as a dry-farming zone – the relatively narrow strip of land between the Gorgan River and the hills that extend westward into the plain at the eastern end of the Alborz range. The higher rainfall received in this zone, as compared to the western steppe, and by extension its agricultural potential (as well as access to good grazing grounds in the hills to the north) have made this zone a more stable prospect for settlement over the long term. This is demonstrated by hints of small-scale prehistoric occupation at a few sites, a considerable expansion of settlement into this zone between the Late Iron Age and Parthian/Early Sasanian periods, and further occupation in the (Middle) Islamic period (Chapter 6.2.3. and Chapter 7.4.6). These periodic pulses of settlement varied in intensity, and impact on the landscape; settlement in the latter two phases resulted in the formation of distinct hollow way systems suggesting considerable movement of people and animals beyond cultivated fields.

The settlement history of the central steppe zone is less well understood. The chronological evidence from survey is limited, but suggests the possibility of a Bronze, or Earlier Iron Age horizon, and some possible later activity (Parthian? Early Sasanian?). This zone, and in particular the area immediately north of the Gorgan River, may have been attractive for settlement, perhaps employing localised irrigation. Furthermore, the seasonal lakes and wetlands located in the depression between the Gorgan and Atrak Rivers would have provided ample resources including fish, and water birds.

In the western steppe, there is some limited, but intriguing evidence for Bronze Age activity (e.g. GWS-14), clear evidence for a surge in settlement and landscape investment from the Late Iron Age, and while the area appears to have been sparsely settled following the Parthian or perhaps early Sasanian period. Now an area characterised by high soil salinity, and primarily used for grazing, this sub-zone would have potentially been more fertile in the past; it has been argued that numerous palaeochannels representing more northerly courses of the Gorgan River were likely active in the Late Iron Age through Sasanian periods. This would have extended the area that could be irrigated by river water via small-scale systems some distance farther north. However, settlement of this sub-zone would likely have been suited to a mixed agro-pastoral economic strategy, due to its aridity. The construction of large-scale irrigation canals, likely sometime in the Late Iron Age to Parthian period, would have played a major role in increasing the northerly extent of sedentary settlement in this sub-zone. The abandonment of this sub-zone by at least the mid to late Sasanian period is likely the consequence of political factors; climatic conditions appear to have continued to be favourable (Shumilovskikh et al. 2016) and the Sasanian Empire clearly had the ability to invest in large-scale irrigation works if it so chose. In the Islamic period, while no formal boundary existed, intensive settlement or irrigation of the western steppe does not appear to have resumed, and the bulk of towns and villages existed to the south of the River, with the north remaining the domain of mobile pastoral groups (al-Tabari 1989 p.59; Wilkinson et al. 2013; Vambery 1864).

The westerly extent of the western steppe sub-zone was also greatly affected by transgressions of the Caspian Sea. That these effects have significantly influenced the visible settlement pattern in this zone is clear. Relict coastlines visible on the imagery and historical accounts of Medieval transgressions (see al Muqaddasi for example) suggest that pre-modern sites and features may have been erased. While favourable conditions for agriculture decrease as one nears the coast (coastal salt flats and marshes predominate) at present, it is possible that settlements along the coast may have existed. These communities may have been engaged in economic activities such as fishing, or accessing/transporting commodities, such as naphtha, obtained from resource rich areas along the coastline (see Fraser 1826 p.15; Muraviev 1871 p.19–20; Napier and Ahmad 1876 p.115–117; Vambery 1864 p.57 for details of the Turkmen groups engaged in trading salt and naphtha). However, depending on the level of the Caspian Sea, this area will also have been used seasonally as in the more recent past. Lightly imprinted remains of what have been interpreted as enclosures or pens associated with seasonal use by mobile pastoral groups (likely of the last few hundred years) have been detected by satellite imagery (Hopper and Omrani Rekavandi in press) (Chapter 3.1.3.1 and Fig. 3-14). Again, due to the lack of pedestrian survey and limited examples of the characteristic tappeh-type sites in this zone, we have a poor understanding of all but its most recent settlement history.

This overview of the long-term settlement histories of the various environmental sub-zones of the plain highlights several important trends, in particular, the contrast between landscape signatures associated with the Late Iron Age through Parthian periods, and the landscape signature of the mid to Late Sasanian period, which were explored in detail in chapters 6 and 7. In sum, these are:

- An expansion of settlement or at the least the increase in the scale of (semi) sedentary settlement, into the steppe margins of the Gorgan Plain beginning in the late Iron Age and lasting likely to the Parthian, but potentially to the Early Sasanian period. Land use associated with these signature landscapes varied geographically, with the development of canal irrigation in the western steppe, and hollow way systems in the eastern steppe, representing in both cases and extensification of cultivation as part of a agro-pastoral subsistence strategy.

- A significant reorganization of the settlement system in the mid to late Sasanian period that involved a retraction toward the well-watered piedmont plains, and large-scale investement in defensive infrastructure. This may have been accompanied agricultural intensification on alluvial fans in the piedmont zone.

I now wish to compare and contrast these patterns with other landscape signatures associated with later territorial empires across the Near East in order to establish what this can tell us about the socio-political and economic organization of communities on the Gorgan Plain between the Iron Age to Sasanian period and the impact of empire.

8.2 COMPARATIVE LANDSCAPE TRANSFORMATIONS IN THE PERIOD OF THE LATER TERRITORIAL EMPIRES IN THE NEAR EAST

The key question that has been hinted at throughout this thesis thus far is, how do these patterns of settlement and land use relate to the activities of the later territorial empires? While it is difficult to answer these questions looking at the Gorgan Plain data alone, we can contextualise these patterns by comparison to other regions. More specifically, we can look at regions where there is evidence for a clear expansion into, or transformation of settlement patterns in, marginal or peripheral regions, that are often seen as related to the activities of major territorial empires in the later 1st millennium BC and early 1st millennium AD. When do these expansions or intensifications of settlement occur, and what forms do they take?

As brevity is required, I have limited this comparison to a relatively small sample of areas for which there already exists a substantial and accessible literature (see Fig. 8.2). While this approach risks leaving out certain regions, it illustrates a range of strategies across time and space – from the period of the Neo-Assyrian to the Roman/Byzantine and Sasanian Empires, and from the Negev to the oases of Central Asia. The purpose of this section is to illustrate where such comparisons can show us similar trends (i.e. similar imperial strategies resulting in particular landscape signatures), but also where, though the resulting patterns may appear similar, they are the result of very different social, political and cultural situations. It also sets the stage for bringing in a wider range of examples in future work. I will also summarise the current thinking on the mechanisms behind these expansions. Finally, I will consider how these patterns compare to what we see in the Gorgan Plain.

8.2.1 NEO-ASSYRIAN LANDSCAPES

The debates regarding how we recognise empire and imperial expansion through the different types of power relationships between core and peripheral regions have been discussed in Chapter 2. While there is room for significant diversity in imperial forms, it has been recognised that there is a considerable shift in how control of peripheral regions is exerted in the Neo-Assyrian Empire (mid - 10th to 7th century BC), perhaps making it the first true territorial empire. This is perhaps evident in the regional survey data from various geographically disparate areas, which suggests that significant landscape transformations occurred in the Neo-Assyrian period that have been almost unanimously been attributed to an imperial initiative (Altaweel 2008; Parker 2002; 2003; Ur 2005, 2010; Wilkinson et al. 2005).

In the heartland of the empire this transformation is evidenced by a massive investment in urban centres, increased rural settlement, and the construction of canals and water management systems both to supply imperial capitals, and to increase agricultural output. In the case of the water management systems, top-down investment is evidenced not just in their scale, but by the fact that they fell out of use with the collapse of the empire (Bagg 2000; Davey 1985; Jacobsen and Lloyd 1935; Kühne 2012; Ur 2005; Wilkinson et al. 2005).

8.2.1.1 THE CIZRE PLAIN

This infilling of landscapes of earlier settlement (i.e. those densely occupied in the Bronze Age), was accompanied by the expansion into regions that would have previously been considered marginal for agriculture, e.g. steppe lands (Wilkinson et al. 2005 p.39). The Cizre Plain, in Turkey near the border with both Syria and Iraq, provides a good example of the Neo-Assyrian imprint on what could be considered an agriculturally marginal region on its northern periphery. While the low population suggested to have been characteristic of this region in the Middle Assyrian period may not have been as low as originally thought, it still appears to be in contrast to that of the Neo-Assyrian period in which site numbers increase significantly (Algaze et al. 2012 p.33). The notable features of the settlement pattern include not just an increase in site number, but also in overall occupied area; sites also appear to be distributed throughout the best agricultural lands (Algaze et al. 2012 p.34–38; Parker 2003 p.544–45). Small rural sites make up the majority of settlements; a lack of intermediate sized sites is apparent, leaving four or five small towns that may have acted as focal points for rural settlement (Algaze et al. 2012 p.35; Parker 2003 p.552).

Patterns of settlement in core regions also indicate an increase in the number of sites, and what appears to be the development of a two-tiered settlement hierarchy (small rural sites with only a few larger centres) (Altaweel 2008) suggesting comparable phenomenon in diverse contexts.

How does this pattern reflect an imperial strategy? Liverani (1988 p.91) proposed a useful model for understanding the expansion and connectivity of the Assyrian Empire; that is a "network, whose mesh thickens". This is in contrast to the 'oil stain model' (also discussed by Liverani 1988: 85) that characterises imperial control as homogenous across large territories, spreading outward from the core "systematically and uniformly". The Assyrians expanded their empire by adding new nodes (though not necessarily contiguous territories) to their network through military campaigns. These nodes could have been forts or fortified settlements. Parker (1997) has highlighted the prominence of forts, and such processes in Neo-Assyrian textual sources. Following the establishment of a military presence, these regions appear to have then been filled with many agricultural settlements; this was often achieved through the settling of populations deported from other regions and such a process has been argued for the Cizre Plain (Liverani 1988; Parker 1997 p.84; Wilkinson et al. 2005). Through time, the regions in between these nodes in the network were slowly infilled (or deliberately not – see Parker 2003 for a discussion on 'buffer zones') through further military campaigns. As such the Assyrian strategy involved "the deployment of agricultural society as a mechanism of control and a structure of socio-economic stability" (Parker 1997 p.84). What were the motivations for this expansion and intensification of agricultural production in the Cizre Plain? It has been suggested that the production of surplus was needed to feed the expanding urban populations in the core region of the empire; the Cizre Plain, though a region that could have previously been described as agriculturally marginal, is only c. 100 km north of the Neo-Assyrian heartlands and well connected via water transport (i.e. the Tigris) that would have enabled the easy movement of bulky commodities like grain (Algaze et al. 2012; Wilkinson et al. 2005).

This top-down approach to management of the landscape further can be emphasised by comparison to later settlement patterns in the same region. From a phase that can be roughly equated to the Achaemenid period through to the Sasanian period, the Cizre Plain appears to far less densely settled. Considerable fortifications from the Hellenistic/Parthian and Late Roman periods have been found; those that date to the latter period relate to the region's role as a frontier zone with the Sasanian Empire. For the

Achaemenid period the surveyors link this decrease in activity as exemplifying the regions transition from "an intensively exploited core agricultural area under Neo-Assyrian control to a relatively marginal rural domain in Achaemenid times" (Algaze et al. 2012 p.39–43); this observation, with slight adjustment could be applicable to the following phases as well, in which the region appears to continue to be economically marginal, though of political or military interest to the later territorial empires. Clearly, the imprint left on this landscape in the Neo-Assyrian period was not replicated in later times. As such, the transformation of the landscape in the Cizre Plain is part of a much wider strategy of investment in urbanism, security and agricultural infrastructure that "could all be seen as the result of a carefully planned program to remake the economy and demography of Assyria" (Wilkinson et al. 2005 p.32).

8.2.2 LATE ROMAN/BYZANTINE LANDSCAPES OF THE NEAR EAST

In various regions of the Near East, the Late Roman/Byzantine period witnesses several notable expansions of sedentary settlement into peripheral regions. Evidence points to the period, particularly between the 4th and 6th centuries AD, in which significant investment was made in water management systems, and rural settlement reached its greatest ever extent into steppe zones. The reasons for the expansion of settlement and the intensification of production in the Late Roman/ Byzantine periods have been suggested to be related to population pressure and the growth of urban centres, or alternatively the development of markets for specific agricultural products (Braemer et al. 2010; Casana 2014b; Decker 2009; Kamash 2010). However, the mechanisms behind these expansions are not universal, and the level of imperial direction is widely debated (see Lavan 2015 for example).

8.2.2.1 THE NEGEV HIGHLANDS

A well-documented peak in settlement and landscape investment occurred in the arid central Negev in Late Antiquity (Avni 1996; Bruins 2012; Erickson-Gini 2010; 2012; Haiman 1995; Hirschfeld 1997; Rosen and Avni 1993; Rubin 1996; Rubin 1991). The construction of a considerable number of run-off irrigation systems was accompanied by an associated increase in rural settlements, along with, on the southern fringes of this zone, increased evidence for the presence of pastoral land use (Avni 1996; Rosen and Avni 1993 p.190).

Settlement of this period in the Negev is characterised by villages - from considerable sized agglomerations to isolated farmsteads (Hirschfeld 1997). In many discussions of the phenomenon several of the larger sites were characterised as towns/urban centres, but more recent scholarship has instead favoured designating them as large villages while acknowledging the presence of urban amenities (they appear to, at the least, never have been towns in the administrative sense according to state bureaucracy) (Decker 2009 p.34).

Accompanying these settlements are a substantial number of run-off irrigation systems that speak to a large investment in the agricultural landscape. These systems allowed for the watering of considerable tracts of land that would have otherwise been too arid for cultivation. Archaeological and textual evidence suggests mixed cultivation including grains, but with a strong focus on vines and fruit trees and possibly olives; it has been suggested that production for both local consumption and export was being undertaken (Ashkenazi et al. 2012 p.55). Decker (2009 p.196) has even suggested that it was the demand created by the wine market that fuelled the expansion of cultivation in this region.

The pastoral economy also appears to have been stimulated by this expansion into arid areas. It has been suggested that transhumant semi-nomads were present in the southern Negev highlands (Rosen and Avni 1993 p.190). These groups moved seasonally between base camps on the edge of the desert proper in the winter (here were found the largest sites) to the north in the summer where they engaged in cultivation and grazed animals on stubble fields, and found seasonal employment on farms of sedentary communities; both primary and secondary products were traded to sedentary communities, however, it does not appear to have been on a commercial scale (Avni 1996 p.73, 84).

The region could be characterised as a frontier zone (and important point of contact between sedentary and mobile communities), though defining a clear military or political frontier would be difficult. The concept of a frontier system involving forts has been abandoned; features previously interpreted as forts have been shown to be fortified farms (Decker 2009 p.63). Furthermore, the presence of isolated farmsteads and hamlets suggests a sense of security prevailed in the region (Decker 2009 p.196). The characterisation of the area as a *limes*-style system, or as an agricultural frontier established as part of an imperial frontier security policy to populate and control the steppe margins is therefore debatable (see Haiman 1995; Haiman 2012; Rubin 1991). Did state level decision-making play an important role in the settlement of this region?

It has been argued that there is little evidence for such an imperial agenda (see Erickson-Gini 2010), though some scholars have suggested that the phenomenon was the result of increasing cultural impact of the Roman and Byzantine Empire on the local population (e.g. Rubin 1996 p.58). More recently, however, the idea that this landscape was transformed through top down organisation or acculturation has been tempered in favour of models that consider the potential development of these systems as a local response to economic opportunities (although see Haiman 2012 for an alternative view). Erickson-Gini (2010 p.198–99) has suggested that the build-up of the Roman army in the region in the late 3rd/Early 4th century AD spurred on local investment; the maintenance of these systems continued through the 5th and 6th centuries AD though the economic impetus for production shifted toward providing for the pilgrim route that had developed.

That this push into the steppe was organised from the bottom-up, perhaps involving local elites and private landowners, is also supported by the diversity in the organisation and distribution of towns and villages in the region that may signify significant autonomy in such decision making processes by local communities (Hirschfeld 1997). Furthermore, based on a categorisation of the types and locations of the run-off irrigation systems Ashkenazi et al. (2012 p.63) have suggested that they reflect in depth knowledge, and responses to change, in local environments. OSL dating of the terraces associated with several of these systems appears to confirm their initial construction no earlier than 3rd or 4th century AD (with some established as late as the 6th century AD), and continued use into the 10th or 11th century AD (Avni et al. 2013 p.343). Clearly, while a peak in the use of run-off irrigation systems in this region occurs in the Roman/Byzantine period, they appear to have remained in use into the Islamic period suggesting their continued use through considerable political changes (Avni et al. 2013; Ashkenazi et al. 2012; Bruins 2012).

8.2.2.2 THE ARID MARGINS AND THE *LIMESTONE MASSIF* (WESTERN SYRIA)

Another relevant example is that of the arid margins in Syria, where again unprecedented growth of settlement, and investment of irrigation systems occurred in the Byzantine period (and in particularly in the 5th-6th centuries AD). In the region of Andarin, for example, archaeologists have characterised five geographical zones with unique settlement histories reflecting the decreasing importance of agriculture and the increasing importance of pastoralism (Geyer and Rousset 2001) (Fig. 8-3). While there was much complexity in terms of environmental conditions and exploitation potential within these zones (see Geyer

2011) they provide a useful framework for which to characterise the nature of Byzantine expansion into the steppe zone. Zone I is an extension of the fertile crescent and naturally the most agriculturally productive. Zone II, with its increased aridity over Zone I, could still be exploited for dry-farming, but the construction of qanat systems, and cisterns in the Byzantine period would have markedly increased agricultural productivity in this zone. This however, did not represent the furthest extension of settlement into the arid margins. To the east, another zone (III), marked by increased aridity (less than 200 mm of rain per annum), appears to have been utilised for both large-scale animal husbandry (evidenced by large constructions interpreted as pens) and cultivation fed by runoff (Geyer and Rousset 2001). This zone, along with Zone IV (in which they have identified a similar pattern of settlements for animal rearing and some run-off agriculture, but in a more geographically restricted pattern), appears to have formed the interface between the irrigated agricultural areas to the west and a zone of primarily nomadic land use further east (Geyer and Rousset 2001; Rousset and Duvette 2001 p.493).

It seems likely that a mixed agricultural strategy was employed in the irrigated zone; it has been suggested that among other things both olives and vines were grown (Decker 2009 p.193). In Zones III and IV it has been argued that the economy would have been based on mixed agropastoral strategy (Geyer and Rousset 2001). In Zone III, for example, Geyer and Rousset (2001) have argued that the economy of the settlements was based on the production of meat, although some dry farming also occurred. The conclusion reached is that that cultivation was for subsistence, but that herding was for "export markets". Moreover, Zone III acted as an interface with the steppe, and nomadic populations. There is very little evidence that this formed any kind of political or military frontier. That a large part of the economy may have revolved around pastoralism is suggested by an examination of the potentialities of land use; there are limited areas outside of the irrigated zone in which cereal cultivation (the most likely crop group for a dry-farmed zone) could be practised (Geyer 2011 p.22). Overall an integrated regional system involving both agricultural and pastoral production may have existed. As such, if we take into consideration land use patterns and the evidence it provides for the local economy, the settlement of the arid margins generates a picture of a zone of interaction.

What were the mechanisms of this expansion? Geyer and Rousset (2001 p.111) see this process as a rapid one: "the zoning appears to reflect a well-controlled spatial organisation, suggesting a "colonisation" rather than a slow, progressive extension of occupation. The adaptation to particularly difficult environmental constraints supports this hypothesis". Does this suggest a state organised programme? If so from where was it directed? What is clear is that like the Negev, this is a rural landscape dominated by villages of varying sizes. Andarin the main settlement in area, while exhibiting features of an urban centre appears to have had only the administrative status of a village even though it may have functioned as a regional centre (Decker 2009 p.33–34). That the development of the region in general was tied to the growth of Andarin has been suggested (Geyer and Rousset 2001 p.120). However, the evidence from the settlement suggests that public constructions were likely funded by the local community; there are no inscriptions on public buildings to indicate state or church involvement and instead the evidence points towards private landowners (Decker 2009 p.43 ,193).

Equally, we can also consider the development of water management systems (qanats) in Zone II, near to Andarin that reflect a considerable investment in the landscape and provide the key to overcoming the natural constraints of the steppe (Decker 2009 p.193; Geyer 2009). Braemer et al. (2010 p.110) have suggested that in the Roman/Byzantine period the development of these systems was associated with varying levels of state involvement; large estates and their functioning were more strongly tied to the state, but the expansion of rural settlement, while encouraged by imperial authorities would have involved decision making and implementation at more local scale. As such, it seems appropriate to characterise the expansion of sedentary settlement and the intensification of both agricultural and pastoral activities on the arid margins as a regional initiative involving investment at multiple scales – possibly supported by the state but without a directed top-down plan.

By way of comparison, the so-called *Limestone Massif* of northern Syria was also settled on an unprecedented scale in the Late Antique period. Indeed, this is probably the most well-known and impressive example of this phenomenon due to the excellent preservation of the hundreds of limestone constructed villages that dot these uplands. Again, the key period of construction appears to have been the 4^{th} and 6^{th} centuries AD (though some features may date back to the earlier Roman period), though occupation may have continued into the 9^{th} century AD (how intensively and continuously is difficult to determine however) (Casana 2014b; Ward-Perkins 2000 p.354).

Dry-farming is possible in the *Limestone Massif* (c. 300-600 mm rainfall per annum), and as such, investment in irrigation systems was not required for cultivation. Current scholarship favours the hypothesis that while production of commodities like olive oil and wine may have been important for export, a mixed farming strategy was undertaken producing goods for both local consumptions and regional and interregional markets (Casana 2014b; Decker 2009).

Analysis of the architecture in these villages suggest that they were privately owned or leased for lengthy periods of time and that considerable capital was required to build them, emphasising the wealth of private landowners and perhaps an expansion driven by local elites (Decker 2009 p.42). These elites may have originated from and been attempting to meet the demand for commodities in regional centres like Antioch, as well as further afield. However, it is not clear at what level the colonisation of these more marginal landscapes was organised (did it officially involve a regional government or was it more informally organised?). Further research may begin to answer these questions. Casana (2014b), for instance, has recently argued that the villages of the *Limestone Massif* cannot be viewed in isolation. West of the *Limestone Massif*, the Orontes Valley has yielded hundreds of Roman and Late Roman sites, as well as canal irrigation systems and the data suggests a peak in settlement in the Late Roman period. This suggests that villages of the *Limestone Massif* are not exceptional, and "evidence suggests that communities in both areas were similarly composed of rich and poor families, scattered across the dense patchwork of towns and villages throughout the region" (Casana 2014b p.214).

8.2.2.3 SUMMARY OF THE LATE ROMAN/BYZANTINE CASE STUDIES

Space does not allow for a detailed discussion of the intricacies of the Late Antique economy. It does seem, though, that there is considerable evidence in the examples presented above for investment by private landowners likely responding to economic opportunities, and embracing available land in more and more marginal areas. Decker (2009 p.72) has noted that, in line with the accepted view of the Late Antique Near East in which there was undoubtedly an increase in large landholdings by fewer individuals, a process of "elite aggrandizement, to the great detriment of those lower down in the social order", there is also clear archaeological evidence from region like the arid margins, for a large number of independent farmers operating at the small and medium scale. This does not mean that the empire did not have a considerable interest in this increasing production, but that it appears not to have been as a result of a state-directed programme.

If we consider these developments to reflect a bottom-up strategy, then there are numerous economic incentives that might have spurred on such development. Kamash (2012) for example has argued for the increase in irrigation systems in the late Roman period being the consequence of the presence of the Roman army. Similarly, for the Negev, Erickson-Gini has suggested that production for sale to the army, and later pilgrims was responsible for driving intensification in the Negev. While economic demand resulting from the presence of soldiers and pilgrims is related to imperial activity, it is not the same as being directed by the empire; equally while these factors may have played an important role in stimulating these local economies they cannot be the only drivers (Whittow 2015 p.142). Casana (2014b p.212–213), for example, has also argued that the expansion of settlement into more arid and more marginal regions is evidence for agricultural specialisation which was "made possible through the existence of thriving markets in agricultural commodities, at which individual farmers or larger landholders could sell their products".

These examples clearly demonstrate that while the impact on the landscape is considerable, the impetus, in particular for the extension of settlement and irrigation into steppe zones is not necessarily the direct consequence of an imperial agenda.

8.2.3 SASANIAN LANDSCAPES

Lastly, I wish to briefly review the patterns of Sasanian settlement and landscape investment that can be gleaned from regional surveys conducted over the past 60 years in both core and peripheral regions of the empire.

8.2.3.1 CORE REGIONS

Archaeological surveys in Mesopotamia and southwest Iran clearly demonstrate massive investment in irrigation and by extension agricultural production in the Sasanian period. Adams' (1962) pioneering survey of the Diyala Plain revealed an immense increase in the number of sites and the total occupied area, notable increases in urban site size, and a considerable investment in irrigation in the Sasanian period. Interestingly, the increase in urban site size appears to correlate to a decrease in medium-sized sites, and is not a consequence of the centralisation of the rural population. Indeed, the picture of the Diyala in the Sasanian period is one of a landscape that was fully exploited (Jacobsen and Adams 1958).

Various regions in the province of Khuzestan have also been subjected to regional surveys and provide a wealth of knowledge regarding Sasanian period developments. Despite initial suggestions of very similar trends in Khuzestan (Adams 1962), subsequent work has indicated variations in settlement strategies, though Adams' work clearly demonstrates a massive investment in irrigation. Wenke's (1975-76) survey of the Susiana region, however, appears to suggest a decrease in aggregate site area from the preceding Parthian period. This fact has more recently led to the suggestion that in the Early Sasanian period, urban growth witnessed in this region was at the expense of rural populations, and this strategy would have made available more land for cultivation (Farahani 2009). As in the Gorgan Plain, however, there are issues with the ceramic chronology (i.e. an inability to discuss anything more fine grained than an overall Sasanian horizon) that makes it difficult to see chronologically nuanced trends.

The Deh Luran Plain provides another example; this time however, the region prior to the Sasanian period could be considered somewhat marginal. Neely's (1974; 2011) survey indicates that overall there appears to be a massive investment in existing irrigation, and investment in new water technology (i.e. sideshot gristmills) and a considerable increase in site number resulting in the expansion of settlement to its greatest extent in this region. In the original survey Neely noted difficulties in separating Sasanian and Early Islamic sites chronologically, and as such they were presented as one group. However, interestingly, there appeared to be at least one urban centre, but the average size of most other sites is less than 1.5 ha (Neely 1974 p.34).

Moghaddam and Miri's (2003; 2007) more recent surveys in the Mianab plain and the so-called "Eastern Corridor" (between Shushtar and Ram Hormuz) indicate other trends. In the Mianab plain they argue that the large-scale irrigation systems found, while maintained in the Sasanian period, were originally constructed in the Parthian period. Site size appears to increase from the preceding period, although there is a slight decrease in overall site number; however, the overall area of occupation appears to remain similar (Moghaddam and Miri 2003). In contrast, their surveys of the Eastern corridor indicate little evidence for

Sasanian occupation. This could result from poor ceramic recognition or be due to the regions limited potential for investing in agriculture (Moghaddam and Miri 2007).

The above summaries suggest that settlement strategies and investment varied from region to region even in the heartland of empire. In both the Diyala and Susiana the increase in the size of urban centres is significant even if there are differences in how the rural landscape appears to have been organised. Indeed, while perhaps more peripheral, a similar increase in an urban centre with a corresponding decrease in the size of other sites is apparent in the Deh Luran data. Moreover, intensification of agriculture, particularly involving either the construction or maintenance of irrigation systems is apparent. These irrigation systems have been seen as part of a state-directed initiative (Adams 1965), though for example in the Deh Luran, Neely (2011 p.249) has suggested that subsequent running of the day to day rural economy may have been limited following these transformations.

8.2.3.2 PROVINCES, PERIPHERIES AND FRONTIERS

Survey data from regions neighbouring the Gorgan Plain however provide a somewhat different perspective on Sasanian period settlement dynamics. In the Upper Atrak Valley in Khorasan, and in the Damghan Plain to the south of the Alborz a slightly different peak in agricultural exploitation appears to occur. To the east of Gorgan in the Upper Atrak Valley, surveys conducted by an Italian team in the 1970s (Venco-Ricciardi 1980 p.62–67) saw increases in settlement and land use, particularly in new areas not previously settled, in the Parthian period. The Sasanian settlement pattern, however, is less well-known due the poor understanding of the Sasanian pottery types in this region. At least one site, Viranshahr, a square fortress with minimal internal architecture, and no extramural settlement, and in excess of c 350 m on each side, very closely resembles sites such as Qal'eh Kharabeh (GWS_1) on the Gorgan Plain. At least three other Sasanian sites have been noted, one of 5 ha and two smaller. Sasanian sites show considerable continuity with those of the Parthian period (60% are located on Parthian settlement), but there is currently little in the way of evidence for intensification or extensification of agriculture or elaborate defensive structures – though Viranshahr may be the exception. Interestingly in the Late Sasanian-Early Islamic period settlement numbers reduced considerably and settlement became focused in one zone of the plain, with the main settlement covering c. 30 ha. Considerable expansion of settlement occurred only later in the Islamic period.

The peak of centralization in the Damghan Plain, immediately south of the Alborz, appears to occur in the Parthian period as well. There is a trend toward decentralization culminating in the Later Sasanian period. Throughout, however, sites do not appear to expand beyond the edges of the area that can be irrigated by river water, or are positioned in the river valley with an eye to perhaps controlling passage through the region, as opposed to increasing agricultural production. However, it seems that investment in large-scale water management, i.e. the dam on the Damghan River, may have occurred in the late Sasanian period.

What about other regions on the peripheries of the empire? Currently, the Mughan Steppe in northwest Iran, one part of the larger Sasanian borderland region in the Caucasus, is one of the best-studied borderland regions in the Sasanian Empire. While earlier settlement has been noted, the pattern of fortified sites with extramural settlement found in close association with large and small canals supplied by the Aras River was established in the Sasanian period (Alizadeh and Ur 2007). This included the site of Ultan Qalasi, characterised as an urban centre or town (Alizadeh 2011; 2014b). Alizadeh (2011 p.74) has argued that this transformation appears to have been “not an indigenous solution to subsistence problems, rather it was an imposition by central government; essentially a top-down phenomenon”. In establishing fortified agricultural settlements, control could be exerted by incorporating the region into the administrative sphere and creating a frontier.

Turning to another frontier region of the empire, we can consider the Sasanian settlement pattern observed for the Merv Oasis. At this time, settlement appears to withdraw to within the well-watered oasis, where sites are closely tied to the Murghab River and irrigation canals. Furthermore, site numbers increase substantially, with a significant number of sites newly founded in this period (only half of the sites occupied in the Parthian period continue to be occupied in the Sasanian period) (Simpson 2014 p.4–5). Site sizes are also significant, with the vast majority of sites less than 4 ha in size (accompanying a few urban sites like Merv, and some towns), suggesting a dense rural landscape. Lastly, there appears to be little evidence for Sasanian period settlement (of the same type and on the same scale) beyond the ‘cultivated zone’ in contrast to earlier periods in which there is evidence for the steppe playing an important role as a zone of interaction with mobile pastoral communities (Simpson 2014 p.7).

What patterns can be drawn from the above? The level of Sasanian investment appears to have varied within the regions mentioned. Clearly, however, trends toward landscape intensification can be seen in both the Mughan and Merv examples. In Damghan, though, land use appears to be closely adapted to the local environment, and more economic benefit may have been wrought by exploiting different zones through diversified subsistence strategies than through intensification (Trinkaus 1983 p.128–138)

8.2.4 THE GORGAN PLAIN IN CONTEXT

Having reviewed several spatially and temporally disparate patterns of settlement and land use related within the period of the later territorial empires (1st millennium BC to early 1st millennium AD), we have been able to identify different ways in which the relationships between imperial powers and local communities have manifested (Table 8.1). The current data suggests that the expansions into marginal zones seen in the Late-Roman Byzantine period in Syria and the Negev may have been part of a combination of bottom-up processes involving large and small landowners (and local or regional governments). These could have been driven by factors such as urban growth, and new markets for specialised products and the presence of state actors, such as the military, creating markets for the products of these regions. This appears to be in contrast to Neo-Assyrian policies that reshaped the landscapes of both core and periphery regions in the first half of the 1st millennium BC. These examples run the range from small-scale local initiatives, to clear imperial projects, and even the result of multiple processes. How do these patterns compare to our picture of the long-term development of the landscape in the Gorgan Plain from the Late Iron Age through the Sasanian period?

The extension of cultivation into the steppe margins of the Gorgan Plain, and what appears to be continuity in settlement location (that is generally within the steppe margins) between the Late Iron Age through to the Parthian periods appears, in the broadest sense, to have been accompanied by an increase in settlement across the plain. However, the details of these processes are obscured by our imperfect knowledge of the ceramic sequence, and a lack of data collected through intensive survey.

While we still have a long way to go in understanding the development and functioning of the sites that develop to the north of the Gorgan River in the arid margins by the late Iron Age, it appears clear that the inhabitants of these sites had adapted their socio-economic strategies to their local environments. This is perhaps most obvious in the eastern dry farming zone where the development of hollow way systems suggests a mixed agro-pastoral strategy combining dry farming with the frequent movement of herds beyond the limits of cultivation – a strategy particularly suited to this environmental zone.

In the western steppe, drier conditions were overcome with the development of irrigation systems, expanding the limits of cultivation further than before into the arid regions. While investment in such large-scale irrigation systems can be arguably seen as a feature of imperial scale investment (as in the case for the water systems associated with the Neo-Assyrian canal systems), the impetus for these developments may have been a local response to increasing interest in the plain by external powers. Furthermore, we cannot yet ascertain if irrigation systems were in place contemporary to the occupation of Iron III sites such as Qelich Qoineq (GWS_16), or at what scale; however, earlier and even possibly contemporary developments in the Misrian Plain, to which there appears to be ties, may suggest local initiatives. As such, even if the North and South Canal were constructed in response to increased economic opportunity spurred by imperial interest in the region, there remains a possibility that irrigation was implemented in the western steppe margins prior to the construction of the North Canal, though perhaps on a smaller scale. The albeit minimal evidence for hollow ways in this landscape may hint at earlier land use practices perhaps involving dry-farming, or small-scale irrigation, and short-range pastoralism. Dating of the North and South Canals is therefore required in order to ascertain when they were constructed and how long a period of time they were in use. The longevity of settlement in these zones, and the likely evolution of these water systems as detailed in chapter 6, however, may speak to maintenance of these systems through mechanisms other than imperial control. In the Negev, a longevity in the maintenance of the run-off irrigation systems has been interpreted as suggesting local organisation in design, implementation and maintenance of water management systems that outlast political changes (Mabry 1996 p.19). As such, it could be suggested that as in the arid margins or Syria, or the Negev, local elites or major landowners could have been a driving force in these processes in the Gorgan Plain.

In any case, the scale of investment in such systems is not in question, and a significant level of capital and a large population would be required for their maintenance. Yet, this may have been accomplished through state, as opposed to imperial-level, influence. Furthermore, we need to consider how we define such a ‘state’. As discussed in chapter

6.3.2 and 6.4.2.1, alternative models to the traditional agrarian state may better fit the evidence, and while we cannot conclusively define the socio-politcal organisation of these communities, we should at least consider these possibilities. That this was unprecedented in the steppe margins is clear, however, without a chronologically nuanced understanding of settlement development in the southern part of the plain, and more particularly information regarding agricultural strategies and irrigation systems it is difficult to assess how the implementation of such irrigation systems fits within the wider view. It is possible that similar levels of investment are found elsewhere, and in focussing on the steppe margins, we run the risk of viewing their development in a vacuum. Although, this type of activity may be, due to factors of preservation, more difficult to detect when it does not occur on the steppe edge. Further intensive survey will help us fill in the gaps in our knowledge.

At the risk then of focusing all of our attention on steppe margins, the stark contrast to later settlement patterns does highlight their importance in understanding the development of this region as a frontier zone. I would argue that there is currently little evidence for a clearly demarcated military or political frontier prior to the Sasanian period, though this could change with further research. Increased agricultural activity in the steppe zone, while clearly increasing agricultural output, would also create a zone that served as a point of interface between the core settlement areas and the steppe proper, as it may have in the arid margins of Syria (Geyer and Rousset 2001). If so, the Achaemenids, Seleucids or even Parthians could have encouraged these developments and the development of a sort of agricultural frontier, if they did not direct them. The steppe margins may have been an important zone of cultural contact where identities, and political and social affiliations were formed and reformed at different scales and through time (Eaton 2005 p.52; Lightfoot and Martinez 1995 p.472; Rodseth and Parker 2005 p.12).

Overall, this pattern contrasts to that of the Gorgan Plain in the Sasanian period in several key ways, namely: 1) a retraction of settlement toward the most fertile regions of the plain; 2) a substantial decrease in the number of sites, but a significant increase in the size of the largest site, and; 3) clear investment in military infrastructure associated with the region's role as a frontier. The concentration of known Sasanian sites in the most fertile parts of the plain appears to suggest, in contrast to regions such as the Mughan Steppe, and even the Diyala, that extensification of agriculture was not a goal, though intensification may have been. It could be suggested that the increase in the size of the largest site on the plain

(Dasht Qal'eh (GWS_54)), indicating centralisation, was either the result of a depopulation of the countryside that freed up agricultural land and perhaps pasture, or was accompanied by an increase in, or at least maintenance of, a substantial population that is represented by low-level relief sites not detected by the survey methodologies employed to date. This could account for the apparent decrease in site numbers seen in the survey data. A flow of population toward urban centres may be seen in the Sasanian period in Khuzestan, a region in which we have evidence for a considerable irrigation network suggesting intensification (Adams 1962; Farahani 2009; Wenke 1975-76).

Alternatively, or perhaps additionally, we may be missing an important part of the rural settlement pattern due to issues of preservation, survey methodologies and ceramic recognition. For example, intensive regional surveys focusing on identifying more than just mounded sites (e.g. low-relief sites, sherd scatters) have resulted in a significant change in how the Late Roman (sometimes called Byzantine or Late Antique) landscapes of Western Syria are viewed (Casana 2014b). The identification of a vast number of sites, many represented by no more than field scatters, in intensive field surveys has 'populated' a landscape that was previously thought to have reflected decline. Indeed, an increase in sites in new locations appears to be characteristic of the settlement pattern of Sasanian Merv (Simpson 2014 p.5).

Of course, our lack of chronological refinement for much of the settlement data is problematic and may be confusing trends, however, we can date with more precision a period in which there appears to be considerable investment in military infrastructure in the plain, that is the 5th and 6th centuries AD. While the interpretation of textual sources has characterised the power of the Sasanian kings as dependent on legitimisation of their rule by the aristocracy, the archaeological evidence for the 5th and 6th centuries AD suggests a strong centralised political system capable of organizing a vast amount of resources and mobilising large numbers of people (Goldstone and Haldon 2009 p.9–10; Payne 2014 p.4–5). On one hand, state-level investment in military infrastructure in Gorgan is undeniable - as such should we assume that the empire was equally interested in feeding its troops, and perhaps engaged in a reorganisation of the rural landscape?

Imperial state-directed reorganisation (involving centralised imperial influence, and more directly the initiatives of regional representatives) does seem to be the case for the Mughan Steppe, which reflects a strategy similar to the much better documented reorganisation of the landscape that took place under the Neo-Assyrian Empire (Wilkinson et al. 2005 p.49). Indeed, possible sources for the populations that came to inhabit the Mughan Steppe in the Sasanian period could have been the mass deportations spoken of in textual sources like Khuday-nameh or the settlement of previously nomadic groups (Alizadeh 2011 p.75). However, unlike in the Mughan steppe, in the Gorgan Plain there would likely have been a considerable existing population and agricultural infrastructure. As such, a considerable rural population engaged in producing surplus for both non-producers in urban centres and the military component of the population that would have peaked during periods when the army was actively engaged in campaigns to the north, but would have been present in at least considerable numbers while the wall was actively in use would make sense.

Nevertheless, it might be folly to try and cast the Gorgan Plain as a bread basket of the empire similar to core regions such as Khuzestan have been (Howard-Johnston 2012 p.96). Exploiting the region to its full agricultural potential may have had to be balanced with security concerns. The retraction of settlement toward the Alborz seems to have been a political decision rather than determined by the limitations of the natural landscape (Wilkinson et al. 2013; Shumilovskikh et al. 2016). Furthermore, the difficulty in transporting bulky commodities such as cereals (particularly over mountainous terrain) and their low value, may suggest that excess production for export was not the primary goal, and that surplus was used to feed regional populations (Bulliet 2009 p.12). However, the possibility of the production of commodities including wine, and dried fruit may have resulted in different economic opportunities. Indeed, the commercialisation of the economy is clearly a factor in settlement expansion and agricultural intensification in contemporary Late Roman/Byzantine examples, such as the landscapes of the Orontes Valley and the *Limestone Massif*. That the Sasanian Empire was tapped into local, regional and interregional trade networks is clear (see Daryaee 2009).

This brings us to consider the connectivity of the empire and how this may have brought about different levels of investment in core and peripheral regions. While, the Cizre Plain could be characterised as peripheral to the Neo-Assyrian heartlands, its location a little more than 100 km north, well-connected by river, may have made it an ideal landscape for the production of surplus to feed growing urban population in those heartlands (Algaze et al. 2012 p.38; Wilkinson et al. 2005 p.44). This reminds us that some 'peripheries' are more peripheral than others in terms of connectivity, and that this can result in very different relationships between empire and local communities, and the way in which power and by extension an imperial imprint on a landscape may manifest. Simpson (2014 p.23) has emphasised in reference to Merv that "extended travel times from one end of the empire to another must have prevented direct meddling of the state in everyday affairs but equally must have enabled administrators, whether civilian or military, to take efficient control of the regions and resources under their purview". The situation in the Gorgan Plain may have been similar, especially when considering the relationship between the plain and heartland regions in which connectivity would have been in part dictated by the Alborz Mountains.

As such, it seems possible that at least in the 5th and 6th centuries AD, as has been observed for other parts of the empire, "the Iranian imperial apparatus, in other words, came to penetrate provincial societies ever more deeply, in economic, cultural, and political terms" (Payne 2014 p.83). Further research, however, is needed to characterise the rural settlement pattern of the Gorgan Plain and the role the empire may have played in reshaping it. Furthermore, we need to consider the role of local elites in these processes, even perhaps as agents of empire, and to what extent imperial impact mediated through local knowledge and influential families. The available settlement data from across the empire suggests that the Sasanian Empire varied its strategy to make the most of local conditions and existing socio-political organisation. Investment strategies varied in heartlands, provincial settings, and of course on active military frontiers. Factors such as the proximity of the frontier to the core regions also likely had an effect on the level of state control, and ultimately on how a frontier region developed.

8.3 LOCAL INITIATIVES AND IMPERIAL LANDSCAPES ACROSS SPACE AND TIME

Wilkinson (2003 p.212–213) recognised the possible relationship between particular landscape signatures and later territorial empires across the Fertile Crescent beginning in the 1st millennium BC, though he noted diversity across time and space, and also allowed for some of the resulting patterns to be what he called "spontaneous settlement".

The examples reviewed here seem to suggest that there is no clear chronological development of imperial impact. The clearest evidence for the role of imperial action in landscape transformations appears to come from the Neo-Assyrian and Sasanian examples;

indeed, the long-term data suggests that the landscape signature of dispersal referred to by Wilkinson (2003 p.211–213), exemplified by both the intensification and extension of settlement and cultivation, reaches its peak in the Sasanian period in the core regions of that empire. On the other hand, those examples presented here relating to the Late Roman and Byzantine Empires in the Near East, while resulting in different patterns, appear to show less evidence for state directed programmes, though the transformation is as great or arguably greater and may have been in part a response to the activities of the Later Territorial empires, and important changes in the economy. The impact of the pre-Sasanian landscape signature visible in the steppe margins of the Gorgan Plain appear may be enhanced by the state of its preservation; however, it reflects a transformation of settlement and land use that is as important as that of the Sasanian period. Unfortunately, it is currently difficult due to the resolution of the data to determine the drivers of this expansion in a satisfactory way.

Focusing on the examples in which we have clear imperial impact, we could also suggest that landscape signatures of empire may also in part be related to the geography of the empire and reflect the long-term histories of the supra-regions in which they originate. Similarities in the landscape transformations, if perhaps not in their scale, brought about during the Neo-Assyrian and Sasanian periods may have much to do with the way in which imperial networks, connectivity and political organisation developed in comparison to those of say the Roman and Byzantine empires. However, while an attempt has been made to identity unifying features, the specific working-out of these trends is unique to each region in which they are manifest and reflect a key feature of empire: diversity. Clearly, a larger study bringing in a wider dataset over a longer period of time is needed in order to explore these trends in more detail.

9 CONCLUSION AND FUTURE DIRECTIONS

This thesis has demonstrated the usefulness of remote sensing for the identification of archaeological sites and landscape features. Remote sensing allows for the 'survey' of large areas in a much shorter time and at much lower cost than could be accomplished via traditional ground base survey. The use of historical (CORONA) imagery provides a window on landscapes that were altered irrevocably in the 20th century AD by intensive agricultural and building programs. This has resulted in the detection of a considerable number of previously unrecorded sites and landscape features, and provided new information on previously recorded sites. However, this methodology also has its limitations. The likelihood of identifying non-mounded sites is low, and the resulting data is limited without associated dating information obtained through field survey. As such, combining this dataset with the available chronological information from multiple sources is essential. However, there are considerable issues with the current chronological data obtained from field survey. These stem from the lack of a long-term, absolutely-dated ceramics sequence for the Gorgan Plain with which to compare survey collections, and the limited publication of ceramic material from survey.

Regardless, while there are clear issues associated with both the datasets, and their integration, I would argue that taken together the resultant dataset is greater than the sum of its parts. Its analysis has resulted in the identification of patterns of land use and settlement relating to specific environmental zones and the social, economic and political situations of particular periods lasting, perhaps a few hundred years, or so-called 'signature landscapes' (Wilkinson 2003 p.9). These signature landscapes are very much a product of the local or micro-environments in which they exist. For example, the signature landscape of the western steppe is comprised of a particular type of settlement system potentially associated with dry-farming, pastoralism and eventually irrigation agriculture that was in use between the Late Iron Age and the Parthian period. A slightly different geography and climate in the eastern dry-farming zone, has produced a somewhat different, though roughly temporally contemporary, signature landscape. As such, this analysis has contributed a more detailed and nuanced understanding of the geographical variation in settlement and land use patterns of particular chronological horizons in the medium term. Clearly, the patterns of settlement and land use that dominates the steppe margins do not represent the only strategies employed by communities of particular periods across the entire plain. They do however, provide us with a model from which to extrapolate and consider in relation to different geographies, and social and poltiical situations.

Furthermore, because these broad landscape signatures (made up of geographically varying micro-landscape signatures) dominate in different subzones of the plain, they allow us to see changes in the spatial distribution of settlement and land use through time. Comparing the patterns observed in these chronological windows allows us to begin to reconstruct how urban and rural settlement forms, subsistence strategies and connectivity changed over the long-term.

The results suggest that significant landscape transformations occurred on the Gorgan Plain between the mid-1st millennium BC and the mid-1st millennium AD. The extension of settlement into the steppe margins, along with investment in irrigation systems between the Iron Age and the Parthian period, are part of the manifestation of a signature of what Wilkinson (2003 p.128–150) called landscapes of dispersal, characteristic of many regions of the Near East from at least the 1st millennium BC. Settlement development in the steppe margins of the Gorgan Plain could have been the result of local developments (that is bottom-up responses to increased economic opportunities), but could also have been influenced by the territorial empires that incorporated the Gorgan Plain into their sphere of interest from at least the 6th century BC. In any case, the steppe margins of the Gorgan Plain likely constituted a fuzzy transitional zone of settlement in which relationships between sedentary and mobile communities engaged in a range of subsistence strategies were formulated, and reformulated, through time as social, cultural, and political factors changed.

In contrast a very different pattern of settlement and land use developed by the mid to late Sasanian period. The threat of raids or invasions from the north were of enough concern to precipitate a retraction of sedentary settlement away from the arid margins, and inspire state-driven investment in defence and likely agricultural production. This thesis has presented several possible models for Sasanian settlement in the Gorgan Plain. Though the details of the rural settlement pattern require further study, a convicing argument has been presented in which Sasanian agricultural investment was focused on the piedmont plains. This may have included investment in small-scale canal systems or qanats. This combination of investment in security and agriculture, while adapted to this particular frontier setting, is similar to that seen in other geographical regions of the Near East as discussed in Chapter 8.2.3. Furthermore, it is clear that these elements formed a complex frontier zone composed of different military, political, social and economic boundaries. The scale of the transformations that occurred in this period are demonstrated by the dominance of the Sasanian landscape signature in the southern half of the plain, eclipsed only by modern agricultural intensification programmes.

The results of this thesis strongly suggest considerable changes in settlement type, location, and land use between the Late Iron Age and the Islamic period. An important, through not the only factor, in these transitions was the incorporation of the plain into successive imperial spheres. It has also, however, highlighted the importance of understanding long-term local settlement histories and considered the strength of bottom-up processes in shaping landscapes.

9.1 CURRENT AND FUTURE RESEARCH

There is still a long way to go in understanding and interpreting the short and medium-term trends occurring within the macro-narrative presented within this thesis. Current research being undertaken by my colleagues and myself as part of the *Persia and its Neighbours Project* focusing on the Sasanian period will hopefully contribute to enhancing our understanding of the distribution and types of Sasanian settlement across the plain. This involves survey and the collection of ceramics from sites identified with Sasanian occupation in other datasets (not the *GWS*), and the investigation of sites with morphological similarities to known Sasanian site types, and other landscape features (e.g. canals) located on the CORONA imagery. Intensive survey at a selection of these sites will be used to determine site area by period, and look at potential offsite activities. A detailed re-study of the ceramic collections made by the *GWS* between 2005 and 2009, along with the collections made from the visits mentioned above is also underway. This data will be published in conjunction with our Iranian colleagues in the near future.

To contextualize this, and future work, there are two key avenues of research that should be undertaken. Firstly, conducting excavation at a number of multi-period sites with the purpose of obtaining a series of radiocarbon dates and establishing a long-term absolute ceramic chronology for the region is crucial. This would allow for the restudy of older ceramic collections. Secondly, a programme of intensive pedestrian survey should be embarked upon. This would allow us to identify low-level relief sites associated with both sedentary and pastoral activities, off-site activity areas, and determine site areas by period. While it would be desirable to survey the entire plain, an initial program of intensive survey within selected areas representing different environmental zones, and with different long-term settlement histories would be an excellent starting point.

These tasks would allow us to address some of the key issues raised in this thesis. These are:

1. Does the lack of evidence for populations inhabiting the Gorgan Plain between the Late Bronze Age and the Iron III period reflect an actual absence of people, or an insufficient knowledge of either ceramic types, or settlement types and locations? It is clear that by the 8th-5th centuries BC a complex settlement system involving the establishment of large, at least semi-permanent, settlements in the steppe margins has emerged. How does this fit temporally with the resettlement of sites such as Tureng Tappeh (KH_123) in the southern part of the plain, and further afield with the Archaic Dehistan settlements in the Misrian Plain? Do we see differences in settlement organisation and site-based economies in these different environmental zones? Detailed scientific analysis of ceramics from a selection of Iron III sites might also be able to tell us about ceramic production and distribution, and shed light on connectivity in these periods. Furthermore, understanding the emergence of this settlement system will provide crucial comparative data for studies of trajectories toward urbanism across the Near East.
2. Is the intensification of settlement and irrigation in the arid margins of the Gorgan Plain the consequence of a local response to interregional socio-political developments associated with the arrival of the later territorial empires? If so:
    a. What is the chronological relationship between irrigation systems and settlement in the western steppe zone? With the establishment of an absolutely-dated ceramic sequence for the periods from the Iron III through to the Sasanian period, and intensive survey we may be able to better pinpoint the peak of agricultural exploitation in this zone. Establishing dates for the construction and use of the canals through techniques such as OSL dating should be attempted.
    b. Similarly, in what period do we see the most intensive activity on and around sites in the eastern steppe zone? Understanding the relationship between off-site sherd scatters and hollow way systems could allow us to determine this.

3. Our knowledge of Sasanian urbanism and rural economic organisation is developing. We can test the theories put forward in this thesis regarding rural intensification on the alluvial fans of the piedmont plains through intensive survey. Furthermore, the apparent gaps in the settlement pattern (e.g. the lack of settlement in the zone between the edge of the alluvial fans and the Gorgan River/Wall) can also be tested. Survey and excavation at Dasht Qal'eh (GWS_54) is also essential and will allow us to characterise this site more fully, and better understand its role with the political and economic structure of the region. Survey in the hinterlands of the site will also answer questions regarding the density of rural occupation and activity that may or may not have existed in its vicinity.

It is the clear that in the periods under consideration significant changes in socio-political systems occurred on the Gorgan Plain that irrevocably changed patterns of settlement and land use. The results of this thesis contribute to toward a better understanding of both settlement and land use during specific chronological periods, but also to the growing body of scholarship on the archaeology of territorial empires in the Near East and Central Asia, their impact, and the complex relationships between imperial powers and local communities.

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The Gorgan Plain of northeast Iran: a diachronic analysis of settlement and land use patterns relating to urban, rural and mobile populations on a Sasanian frontier

In two volumes

Volume 2

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Appendix

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Submitted in requirement for the degree of Doctor of Philosophy

Department of Archaeology

Durham University

2017

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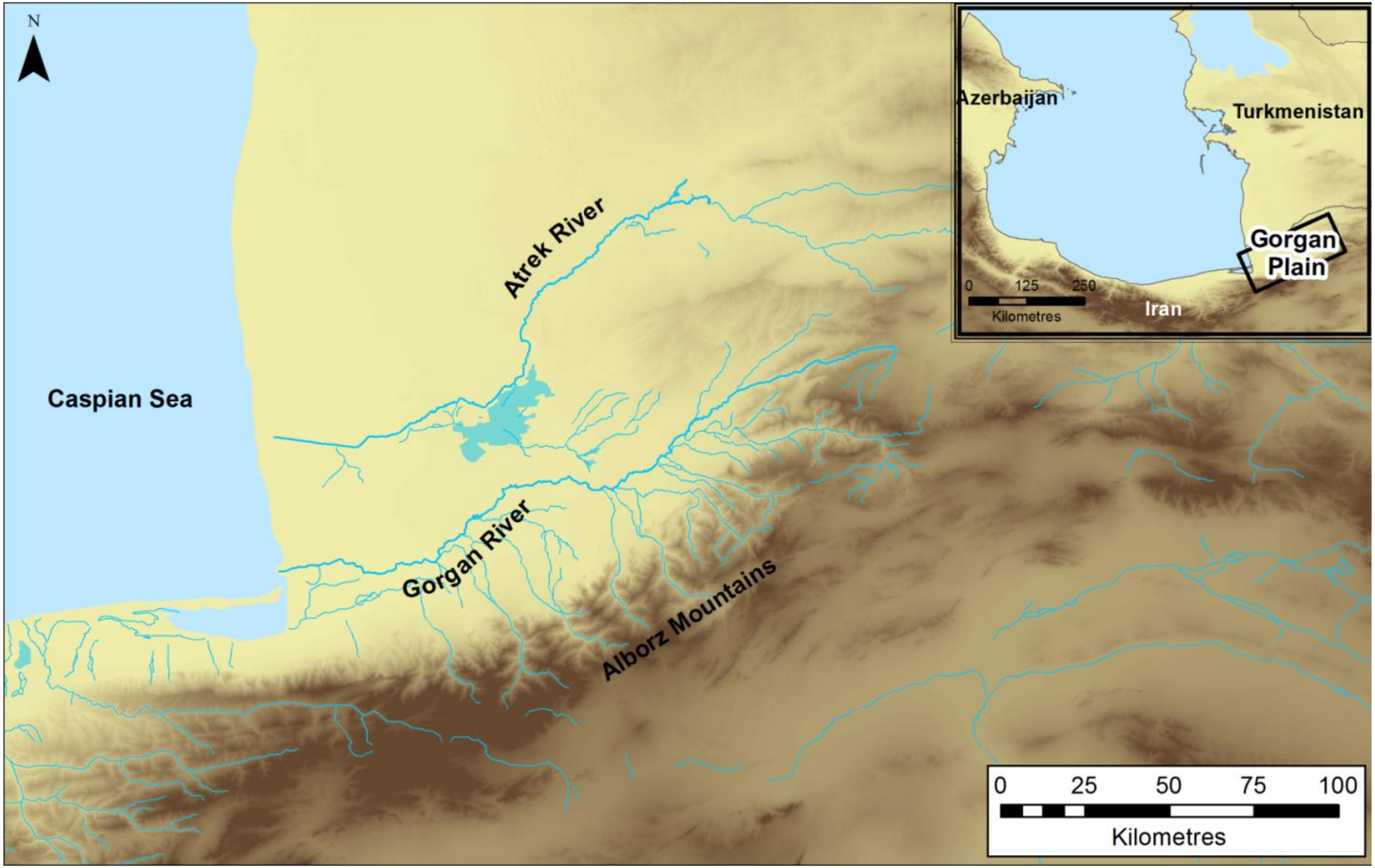

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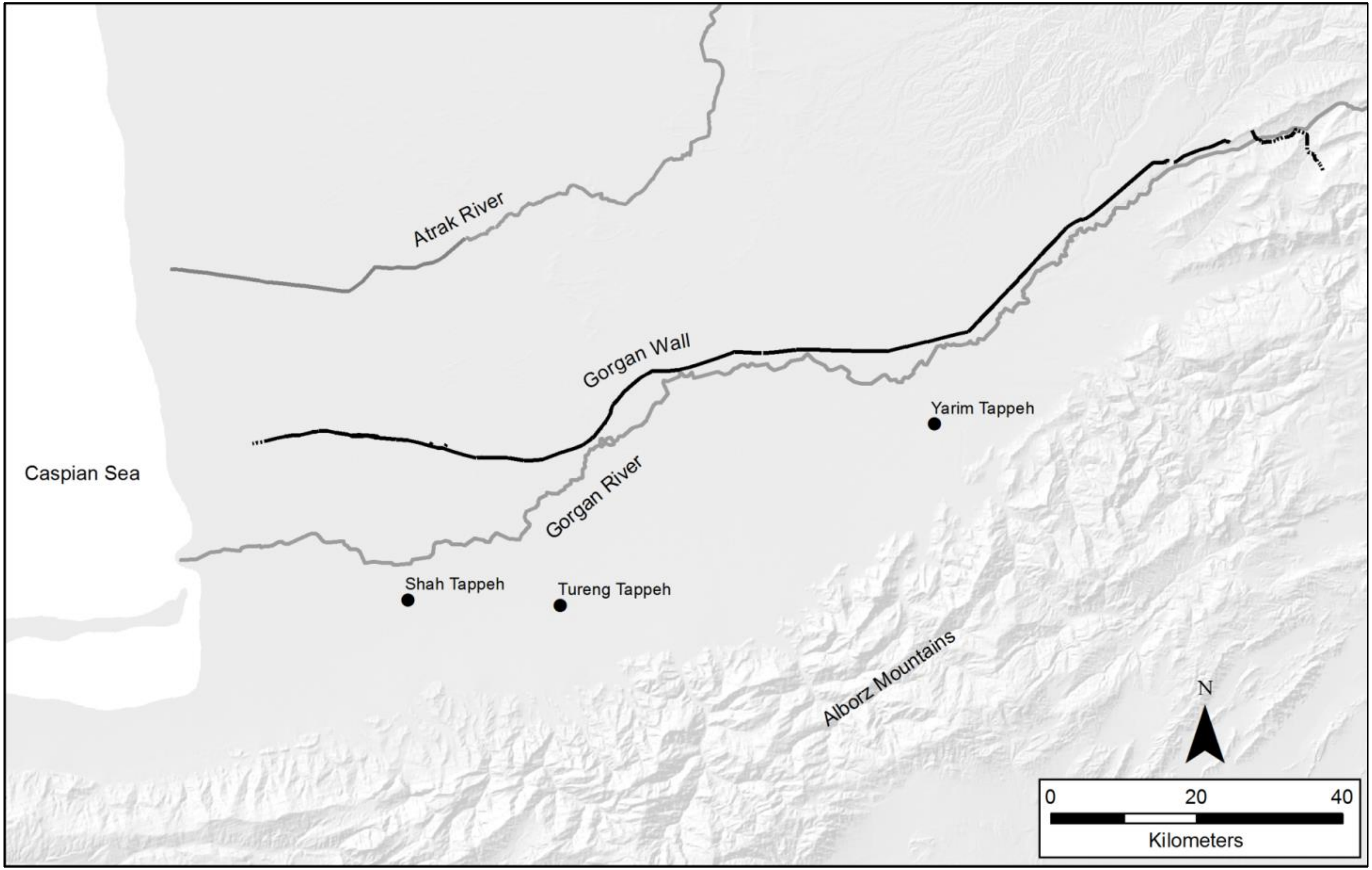

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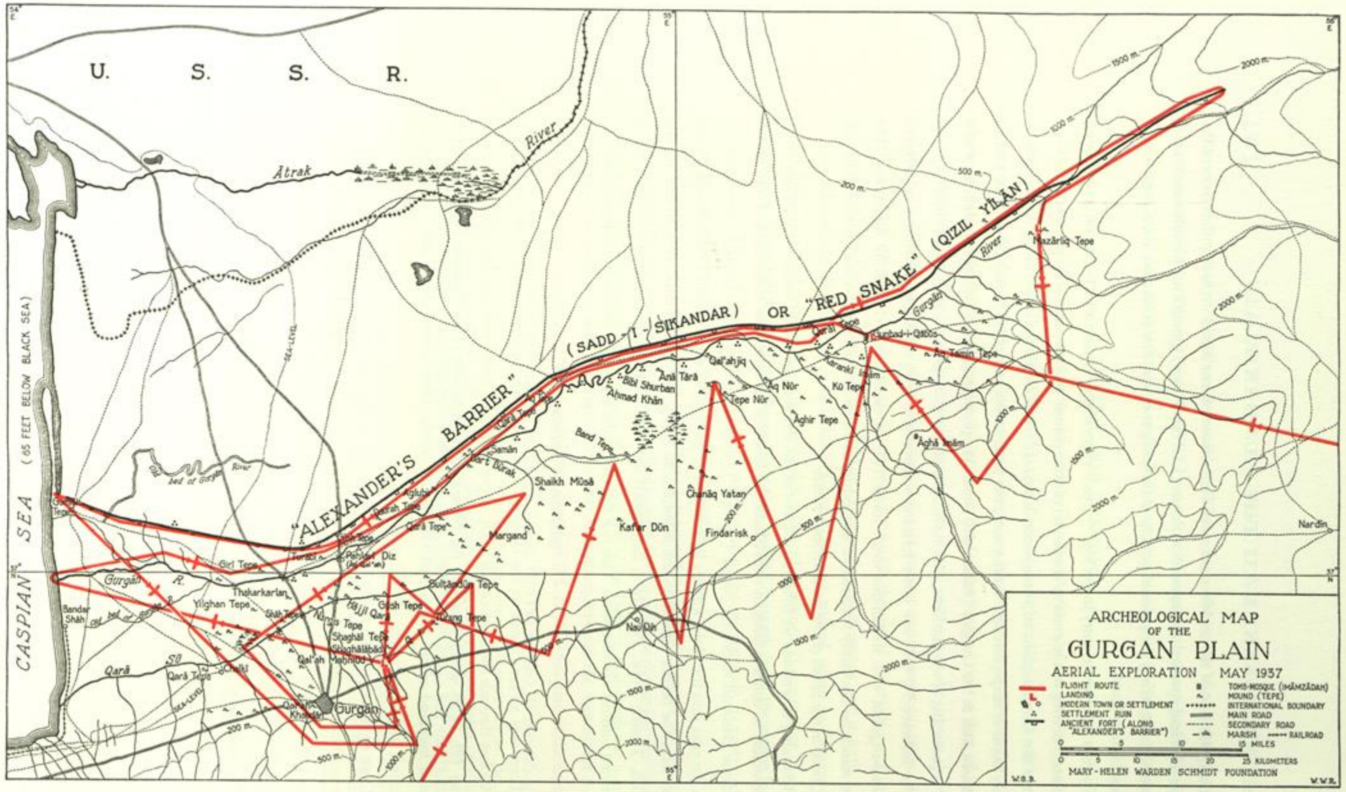

THE GURGAN PLAIN, BASED ON SURVEY OF INDIA MAPS WITH THE PERMISSION OF THE SURVEYOR-GENERAL OF INDIA AND OF THE CONTROLLER OF HIS MAJESTY'S STATIONERY OFFICE

The lines of flight show our aerial zigzags during one and a half days of explorations. We completed one task, a survey of "Alexander's Barrier," tracing it for a distance of 170 kilometers from the Caspian Sea to the point where the eastern mountains continue this extraordinary system of defense. The identifications of certain mounds are based on the archeological survey by T. J. Arne published in his "La steppe turkomane et ses antiquités" in *Hyllningsskrift tillägnad Sven Hedin* (Stockholm, 1935).

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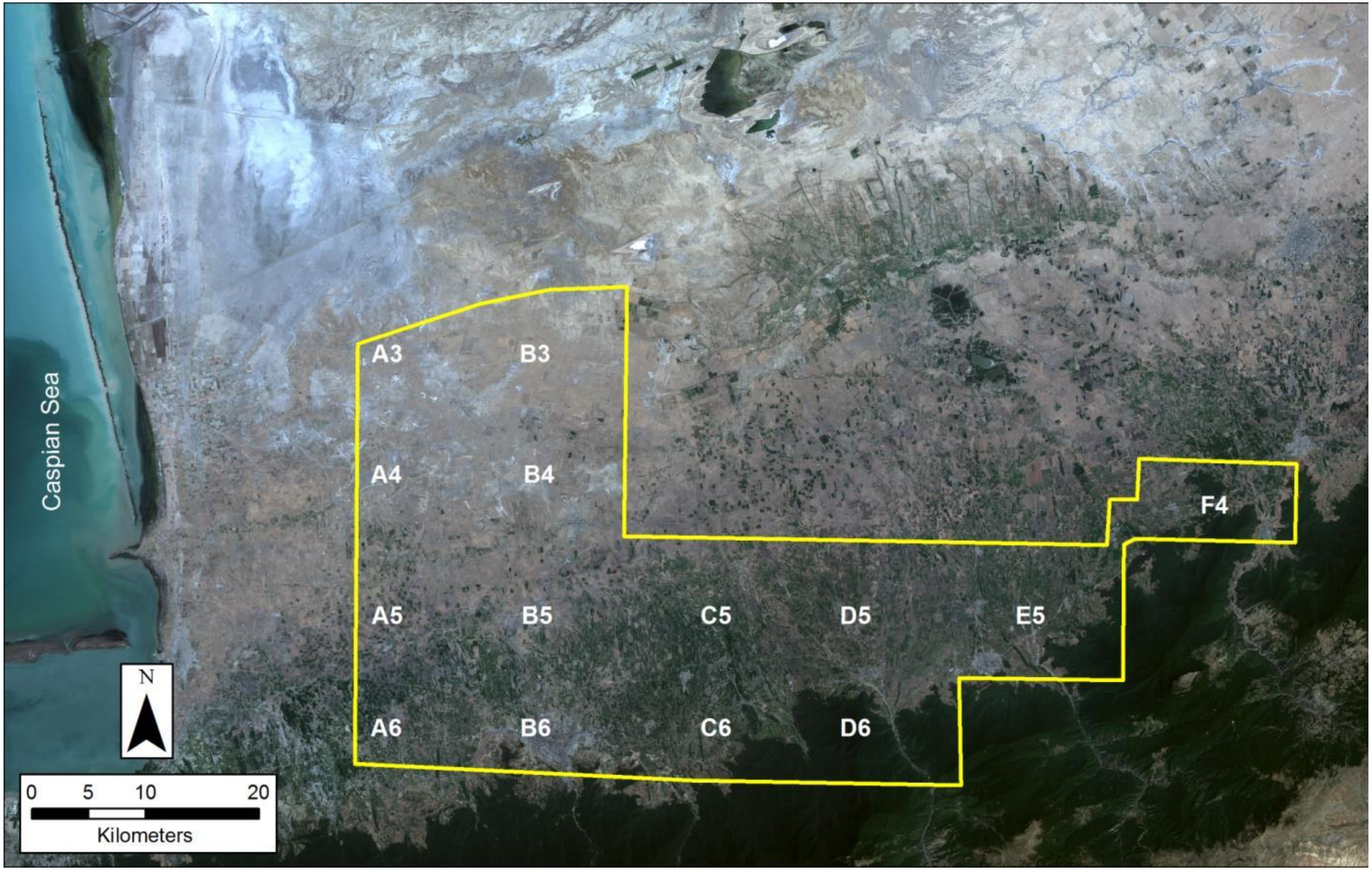

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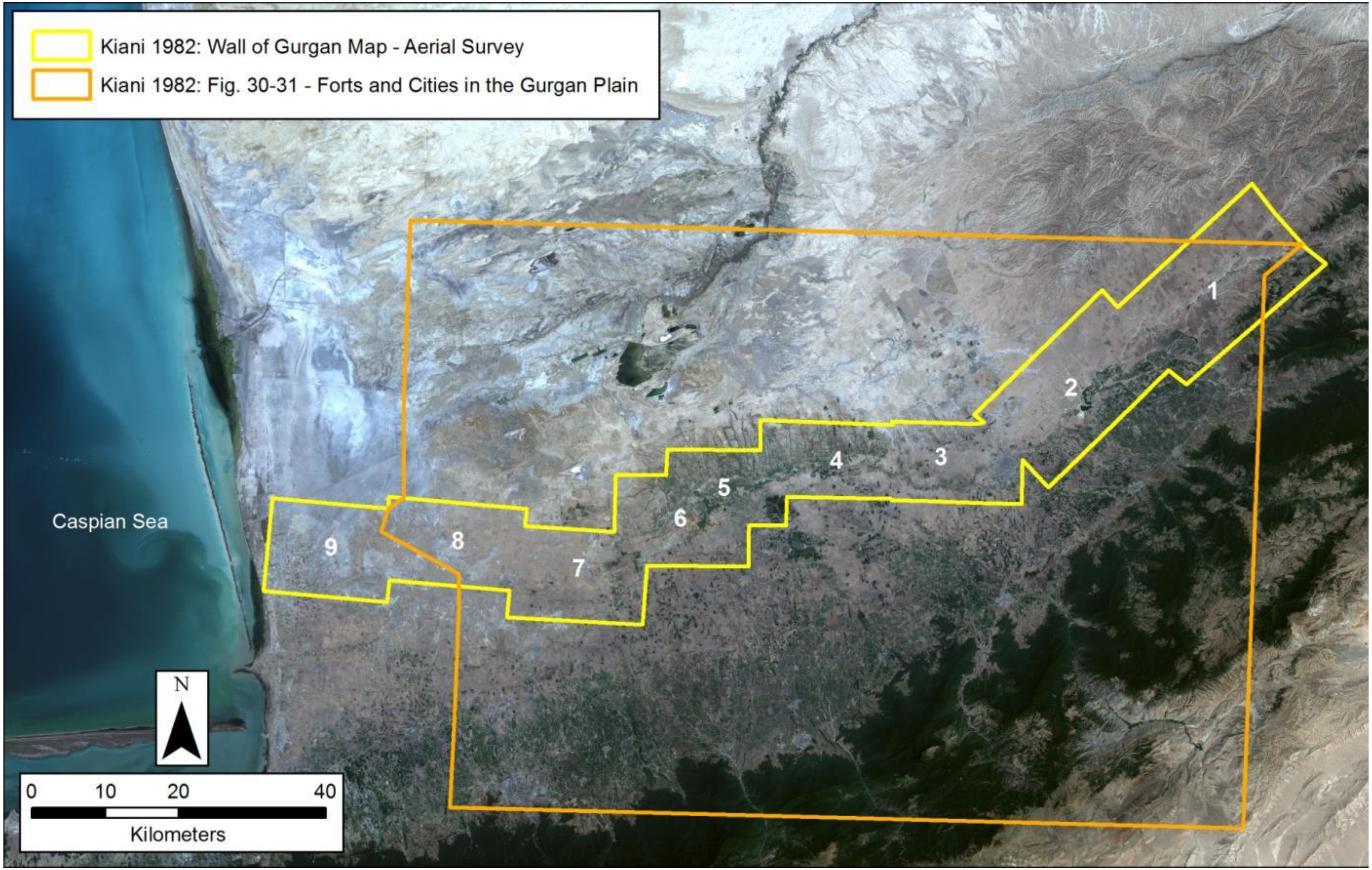

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3. METHODOLOGY

Table 3-1: Types, and coverage, of imagery used in the analysis.

IMAGERY	DATE	RESOLUTION	TYPE	COVERAGE WITHIN THE STUDY AREA
CORONA KH-4A mission 1052	06 October 1969	c. 2-3 m	Panchromatic (PAN) -	Full. Approximately 13000 km² within the study area including the Alborz Mountains.
GAMBIT – KH7 mission 4024	23 January 1966	c. 0.7 m	Panchromatic (PAN)	1 strip covering an area of c. 990 km² within the study area
Landsat-7	20 July 2000 30 July 2001	15m (PAN) 30m (MS)	Panchromatic (PAN) and multispectral (MS)	Full
SRTM	2000	90 m	N/A	Full
QuickBird/IKONOS; WorldView 1; WorldView 2/GeoEye-1/SPOT	2003-2014	c. 50 cm (PAN); c. 2m (MS)	Panchromatic (PAN) and multispectral (MS)	Full (Available from different years and at different resolutions through Google Earth)

Figure 3-1: Example of a Landsat image. (L) A colour infrared image (CIR) generated from the multispectral imagery. Red indicates healthy vegetation. (R) A panchromatic image (Imagery available from the US Geological Survey).

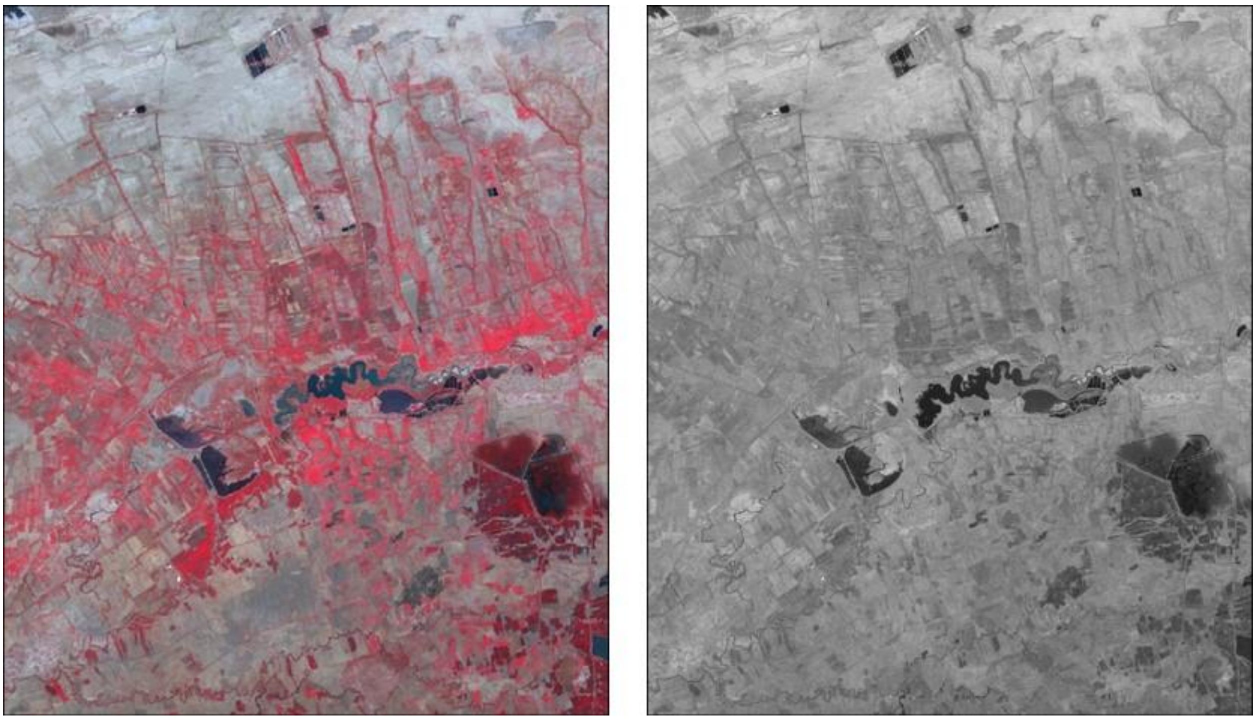


Figure 3-2: Coverage of the CORONA imagery. The yellow dotted line indicates the study area for this thesis. Base map - SRTM 90 m. Imagery available from the US Geological Survey.

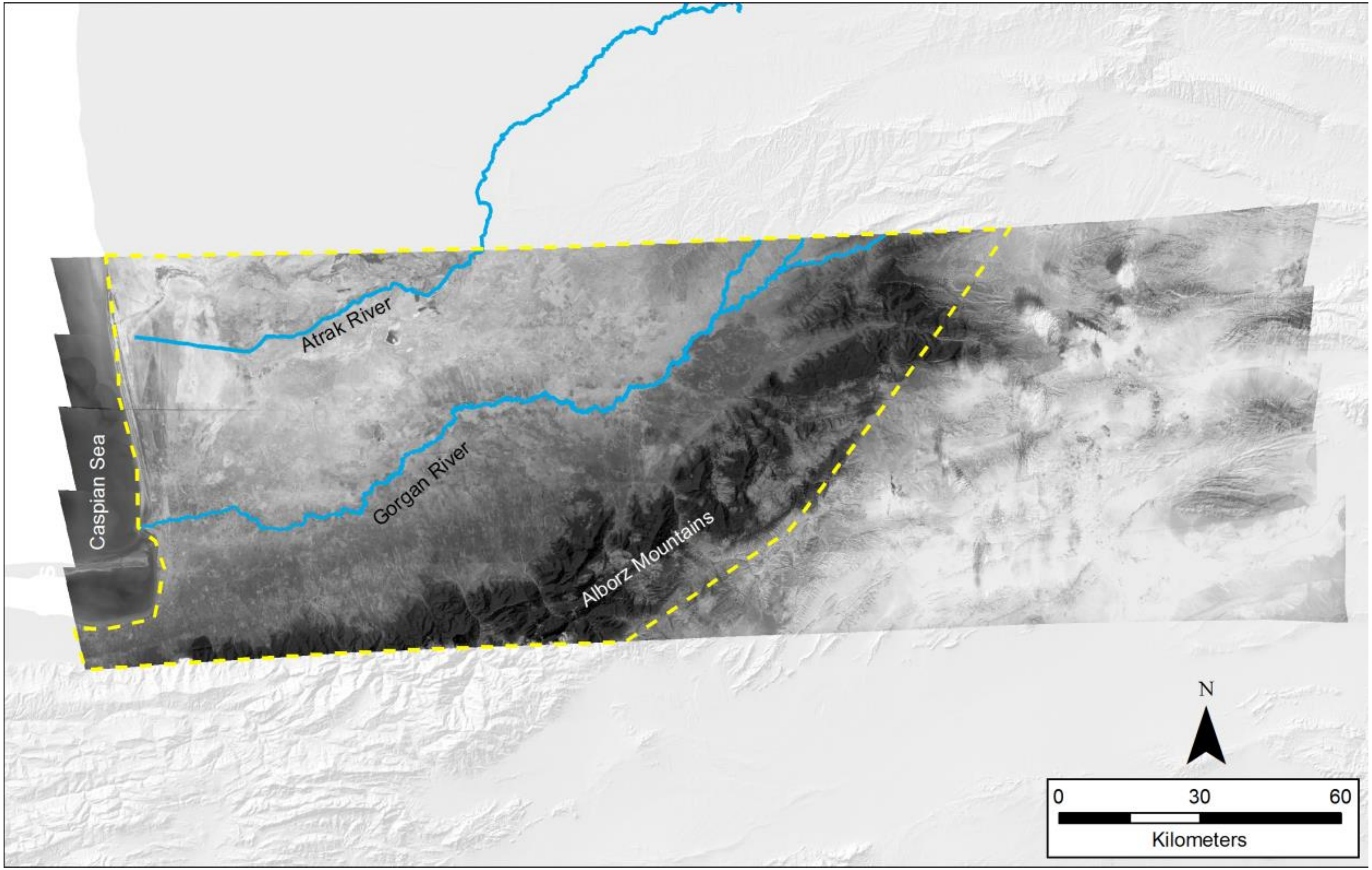


Figure 3-3: Example of a CORONA image (Imagery available from the US Geological Survey)

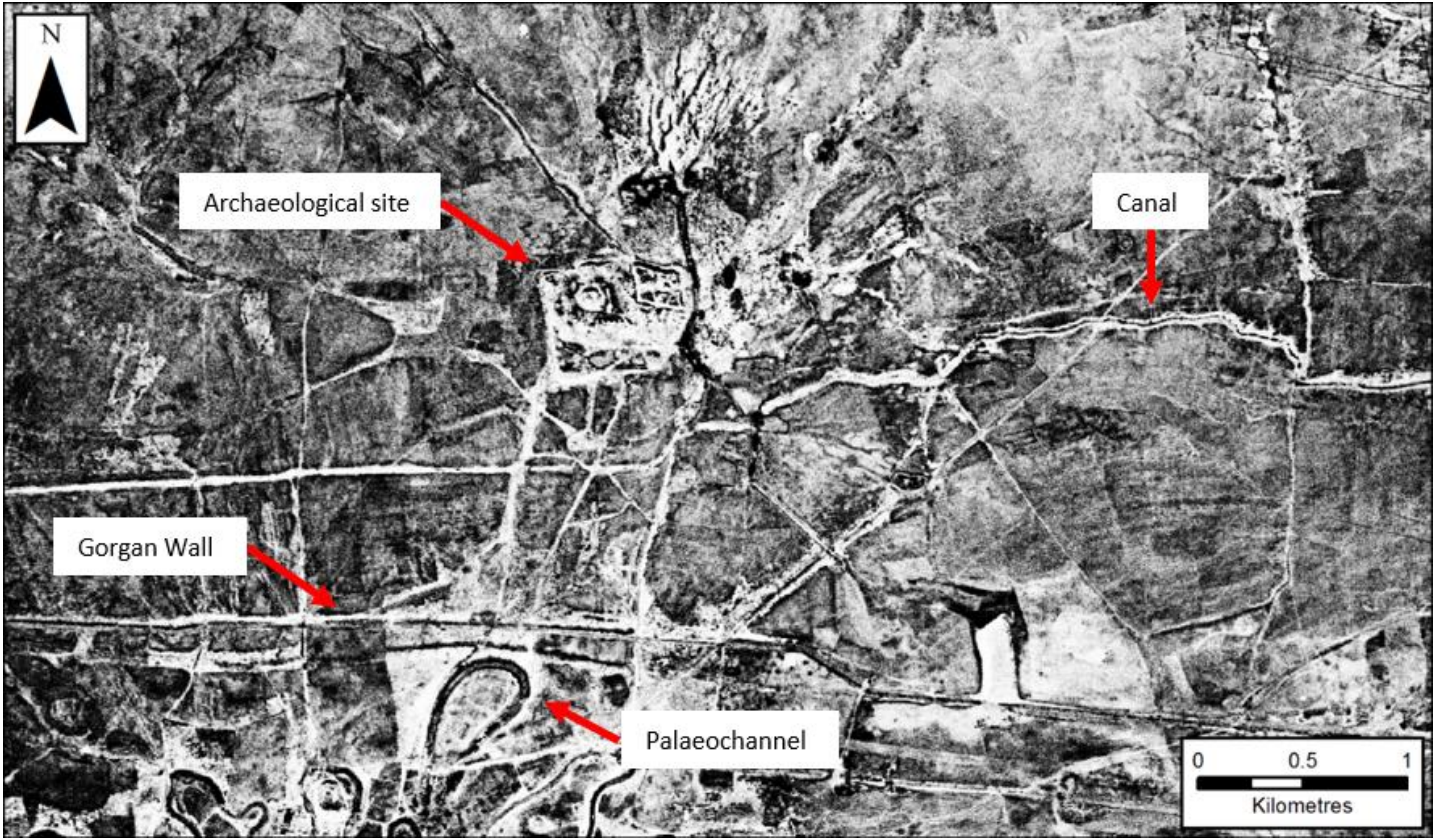


Table 3-2: The most common feature types identified on the CORONA imagery.

FEATURE	DESCRIPTION
Walls/linear features	The Gorgan Wall is distinguished by a straight dark line representing the ditch to the north of the wall. Surviving sections of the wall create an uneven light coloured line immediately to the south of the ditch.
Forts (and outer settlements)	Rectilinear features and outlying settlements along the length of the Gorgan Wall.
Archaeological Sites	Archaeological sites appearing on the imagery as raised mounds or areas of differential reflectance.
Burial mounds/cairns	Small light coloured mounds, sometimes found in clusters usually located in areas not under agricultural cultivation.
Hollow ways	Dark linear features, sometimes with diffuse light coloured edges radiating from sites that represent routes or droveways.
Canals/Channels	Linear features characterised by dark lines, bordered by distinctive light borders representing upcast banks.
Qanats	Small white ‘dots’ extending in lines (some for several kilometres) following natural water drainage patterns usually radiating from the foothills of the Alborz Mountains.
Field systems	Rectilinear patterns of intersecting lines dividing areas of agriculturally productive land. These fields systems are usually cut by newer field boundaries that divide the arable land into larger parcels.
Terracing	Light parallel lines following the contours of slopes in the foothills of the Alborz Mountain. More common in the eastern portion of the plain.
Paleochannels and relict meanders	These ‘old’ river courses and meanders are usually darker in colour and more faintly incised than current channels.

Figure 3-4: Fort 15 on a CORONA image. Note the light parallel lines within the fort denoting barrack blocks (Imagery available from the US Geological Survey).

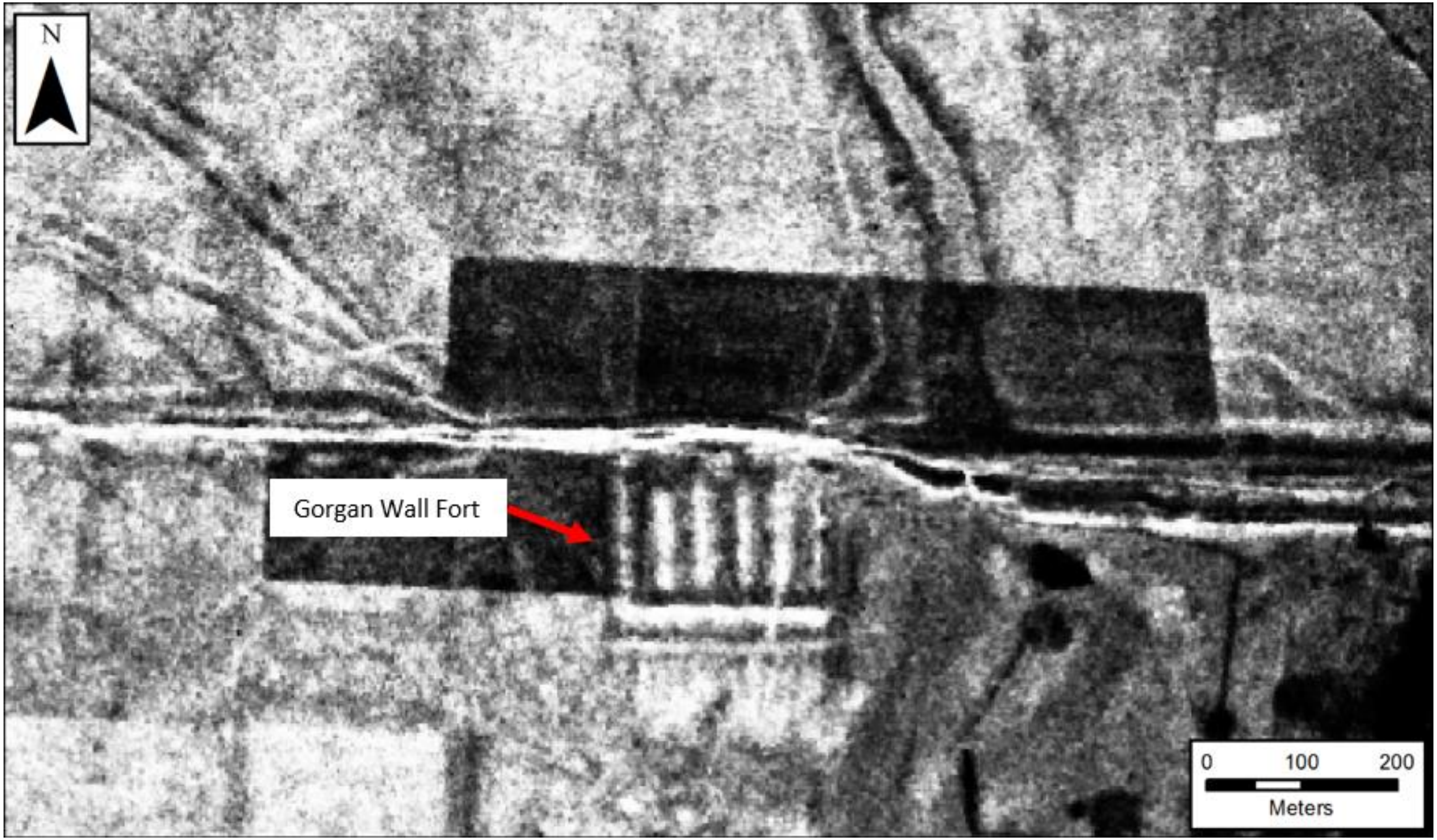


Figure 3-5: CORONA image of wall section and Fort 25. Note possible outer settlement (Imagery available from the US Geological Survey).

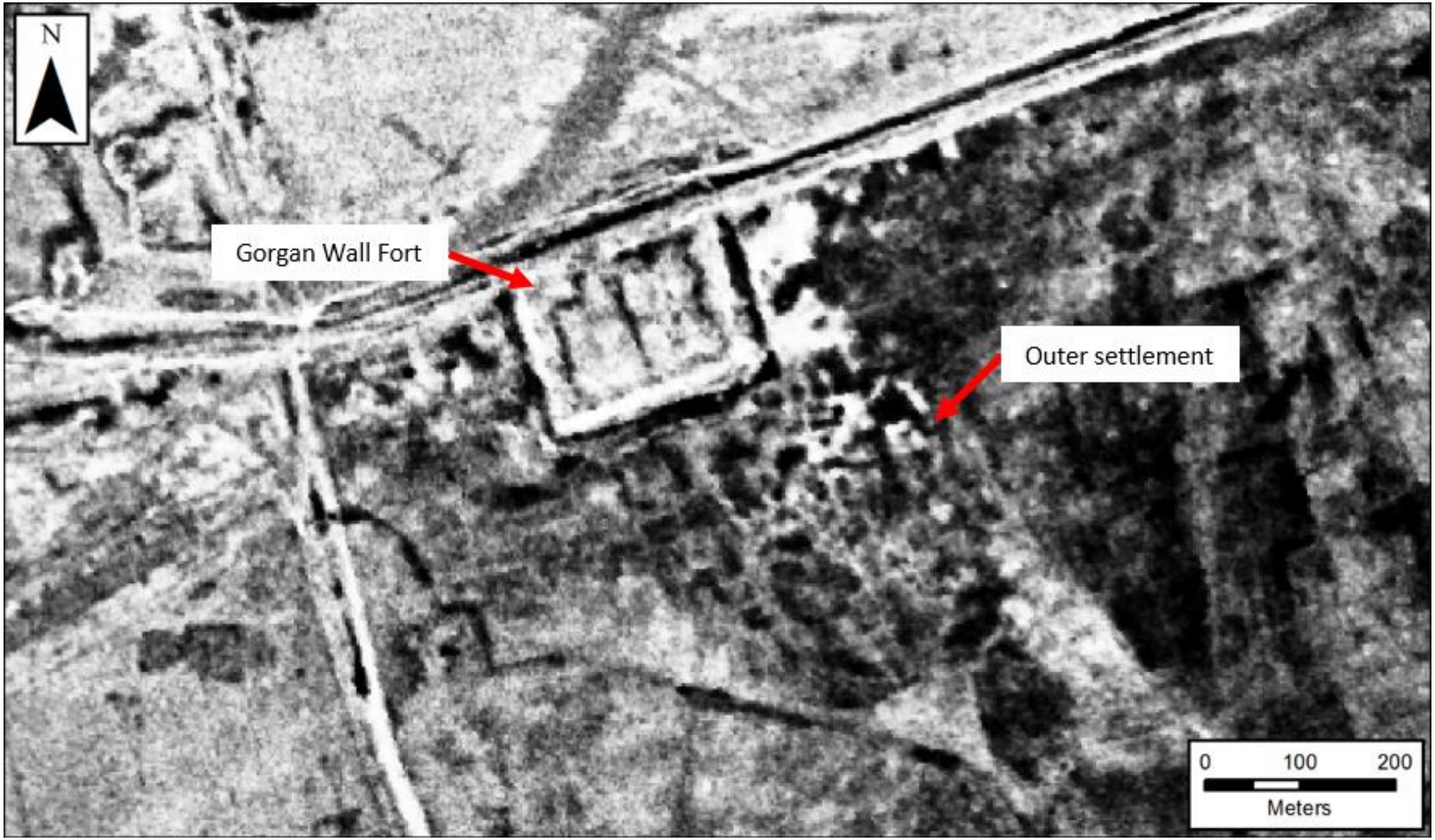


Table 3-3: Site types identified on the CORONA imagery. After Wilkinson et al. 2013: 43-46 with modifications and additions (imagery available from the US Geological Survey).

TYPE	DESCRIPTION	APPEARANCE ON CORONA	EXAMPLE
Qal'eh (sometimes with a second lower qal'eh)	Mound with concave interior.	Mounded sites cast a shadow visible on the imagery. Concave interior is visible as a darker area with lighter edges.	
Qal'eh and outer town with or without ramparts	Qal'eh with an outer town (often represented by low mounds) sometimes surrounded with ramparts.	Mounded sites cast a shadow visible on the imagery. Outer towns often have a mottled appearance representing the undulations of smaller lower mounds. Ramparts are usually represented by a light-coloured (higher relief) line surrounding the mottled area, and can also cast a shadow.	

TYPE	DESCRIPTION	APPEARANCE ON CORONA	EXAMPLE
Geometric sites	Mostly square or rectangular sites with ramparts.	Light borders representing walls or ramparts (which are higher relief than the surrounding landscape) surrounded by darker ditches outline the fortified boundaries of the sites (many have internal features)	
Tappehs	Mounded sites of different morphologies with the most common being circular/ovoid. Irregular, and rectilinear tappehs are also found.	Mounded sites cast a shadow visible on the imagery. There is no concave interior; this distinguishes them from qal'ehs.	

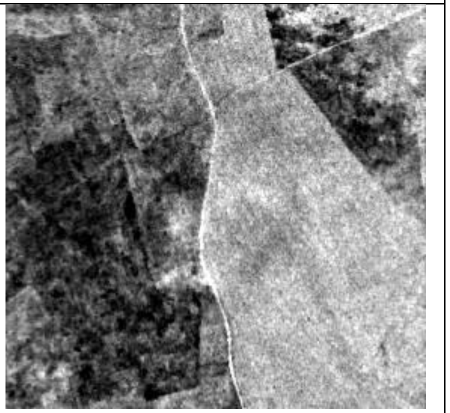
TYPE	DESCRIPTION	APPEARANCE ON CORONA	EXAMPLE
Complexes of low mounds	Similar to tappehs, but lower and less prominent. Often found in groupings, sometimes surrounding more prominent sites.	Mounded sites cast a shadow visible on the imagery. Often irregular in form as they consist of several low mounds grouped together.	
Flat sites	Flat, or low-level relief site representing a dispersed settlement or a mounded site that has been ploughed out due to modern agricultural practices.	Distinguished by a different soil colour than the surrounding area. Often these sites have a mottled appearance and diffuse edges.	

Figure 3-6: CORONA image of possible tumuli or burial mounds (Imagery available from the US Geological Survey).

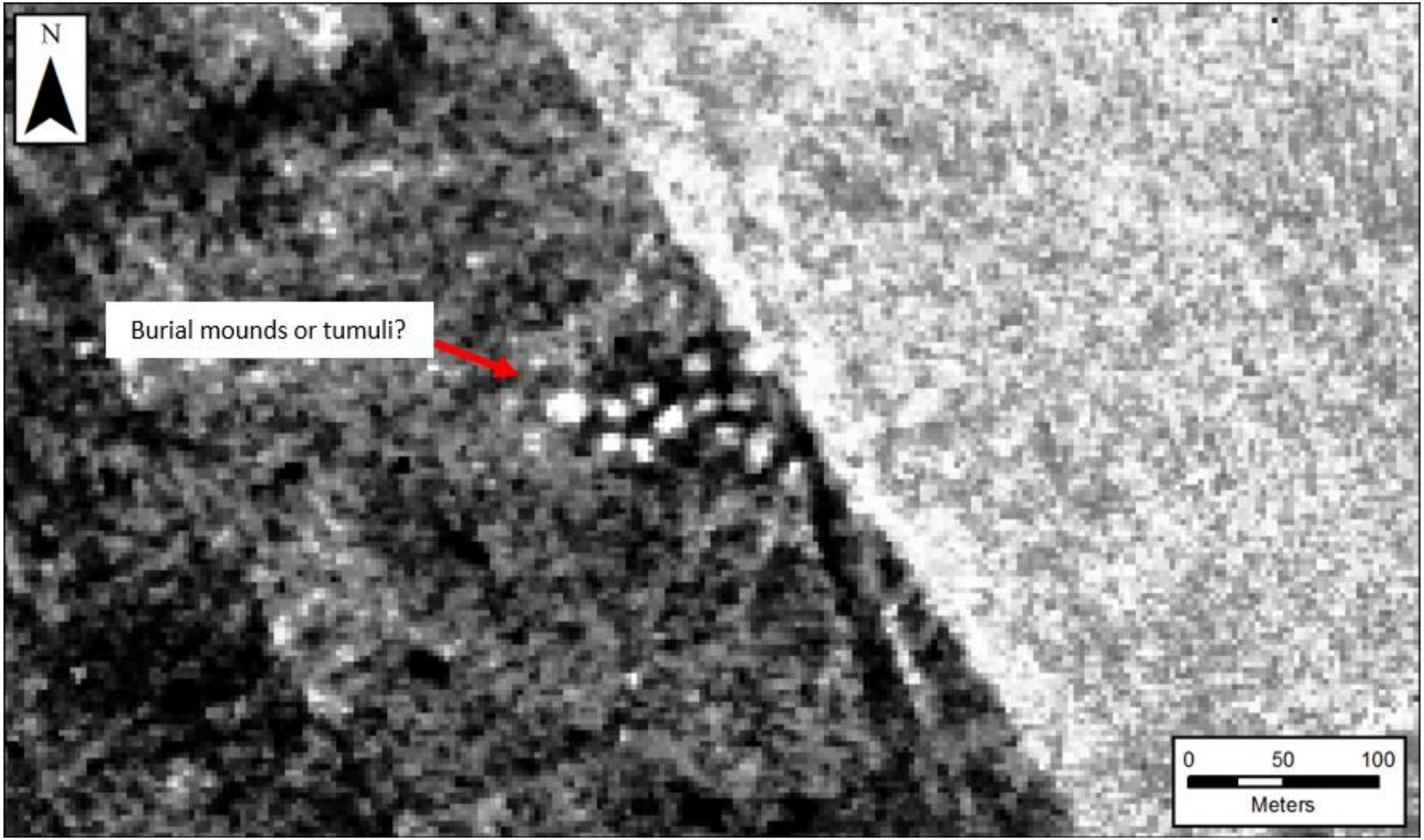


Figure 3-7: CORONA image of hollow ways surrounding an archaeological site (Imagery available from the US Geological Survey).

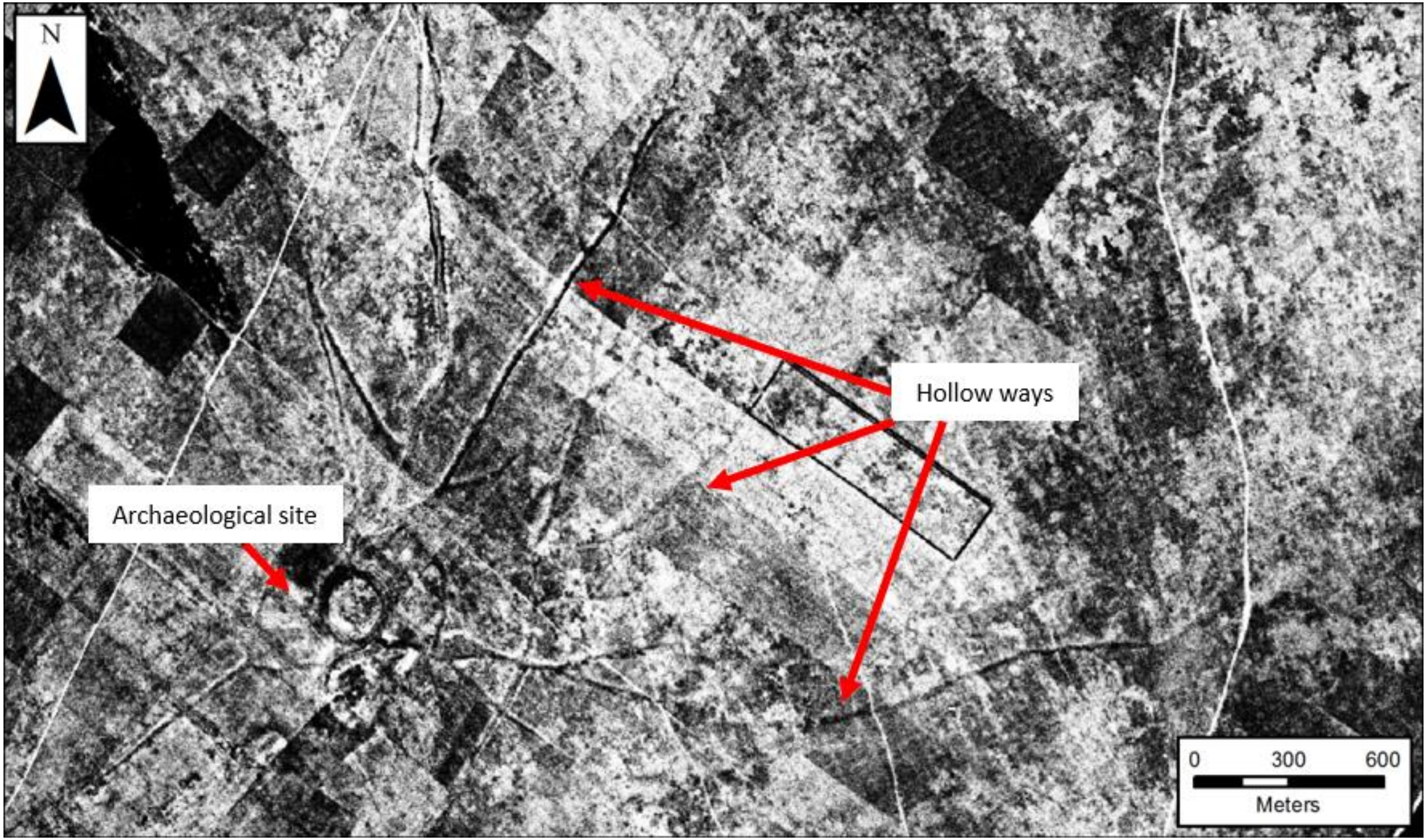


Figure 3-8: CORONA image of palaeochannels and relict meanders of the Gorgan River (Imagery available from the US Geological Survey).

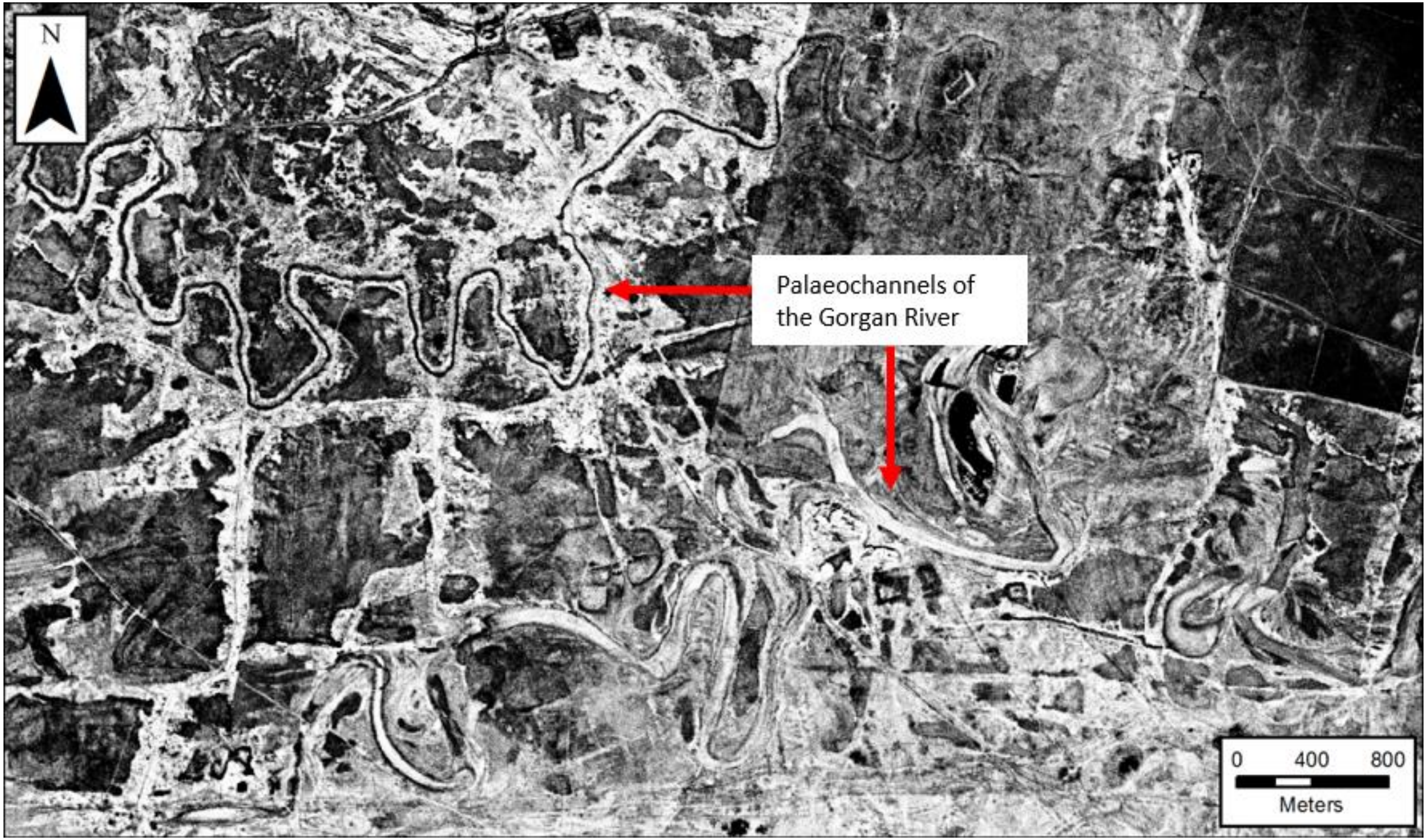


Figure 3-9: CORONA image of canals on the Gorgan Plain. Note the relict field systems to the south of the northern canal feature (Imagery available from the US Geological Survey).

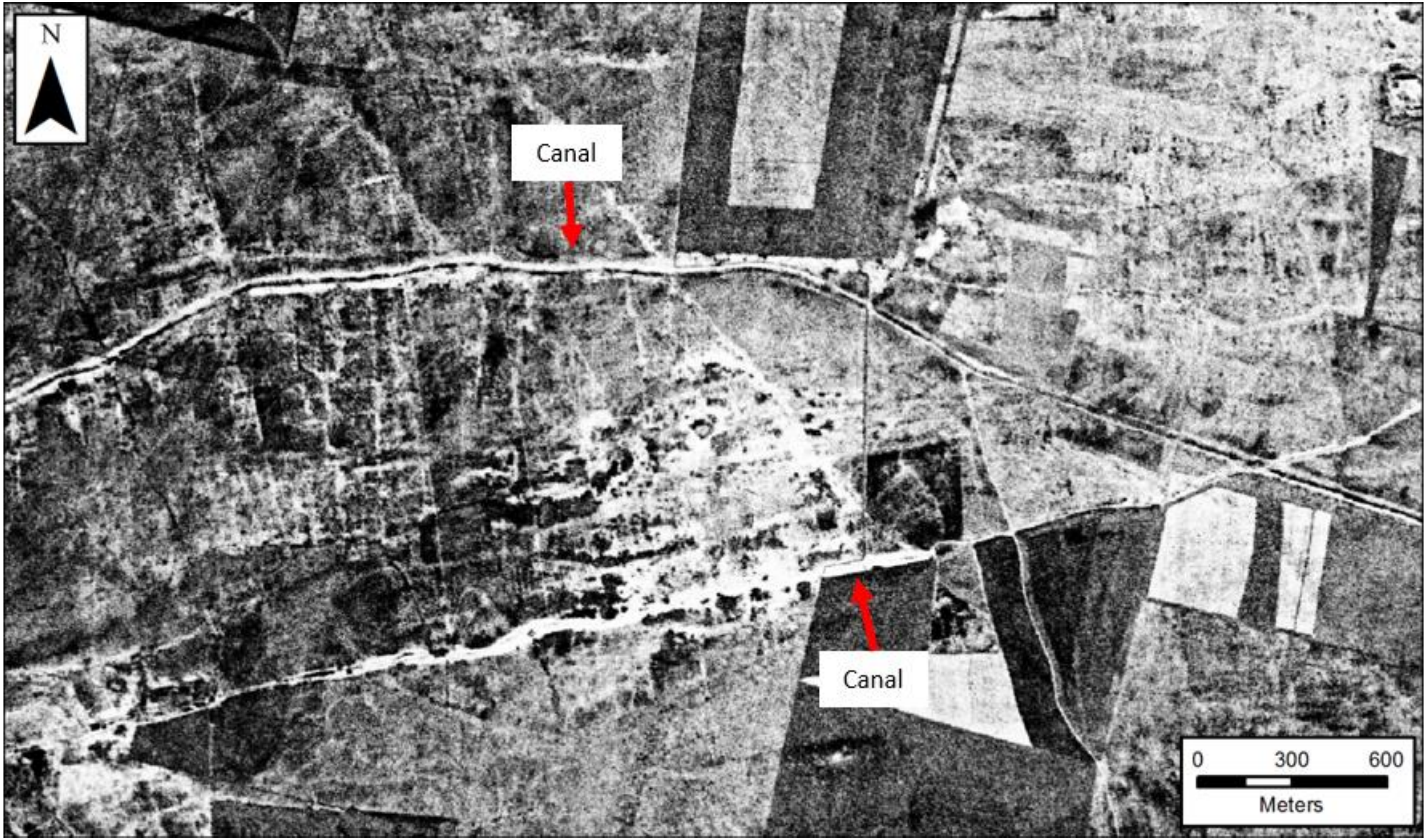


Figure 3-10: CORONA image of qanats and several mounded sites (Imagery available from the US Geological Survey).

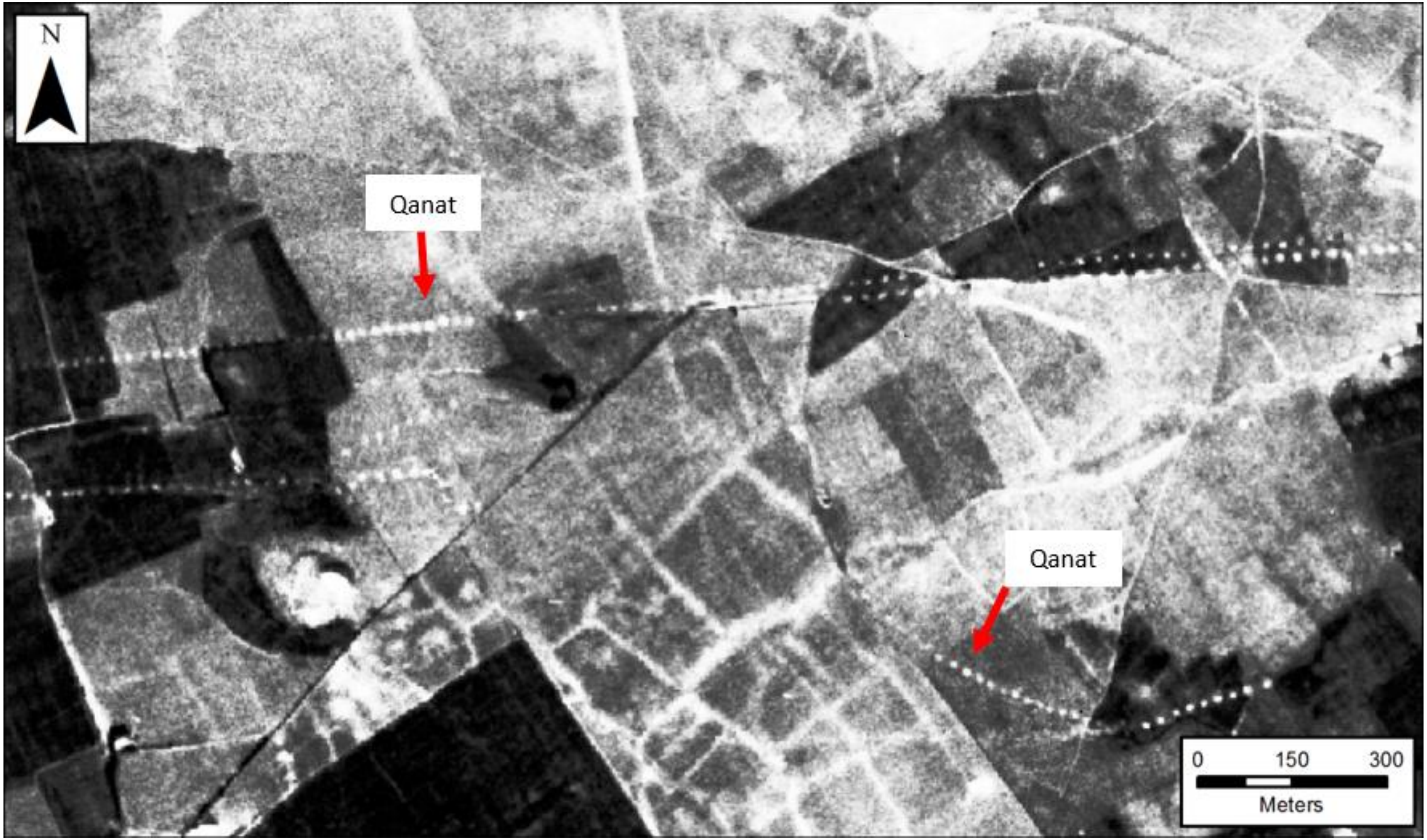


Figure 3-11: CORONA image of ancient field systems. Notice the different alignment of the modern large, square fields to the south (Imagery available from the US Geological Survey).

Figure 3-12: CORONA image of terrace field systems (Imagery available from the US Geological Survey).

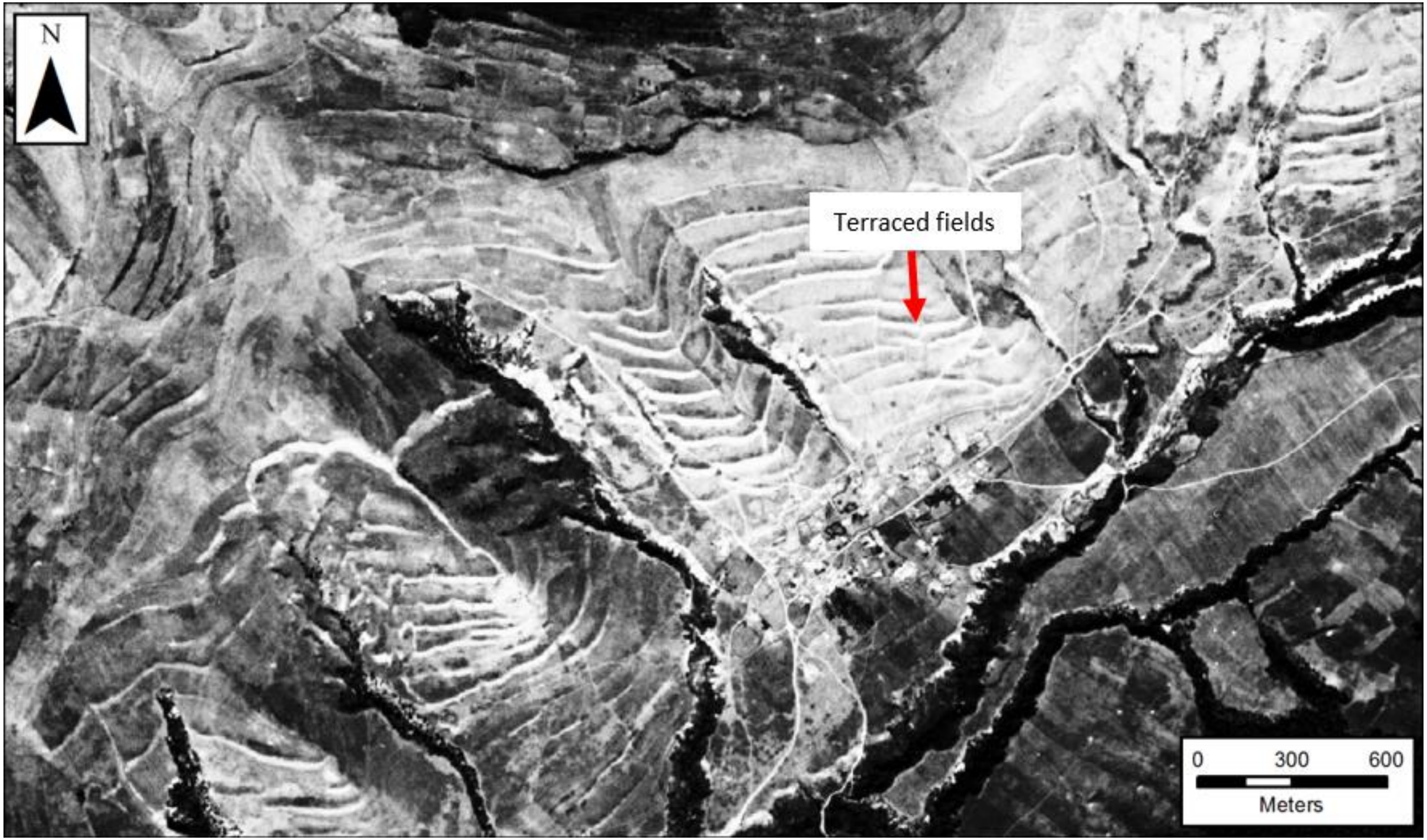
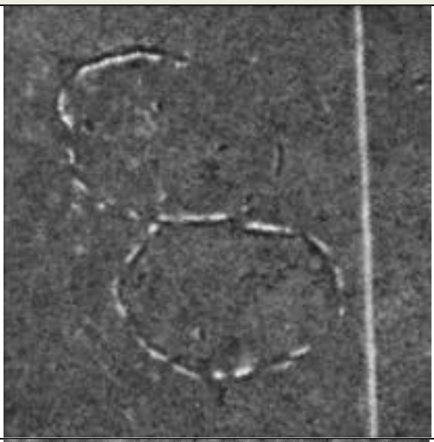
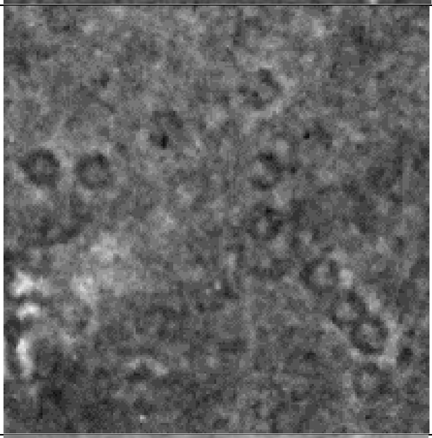
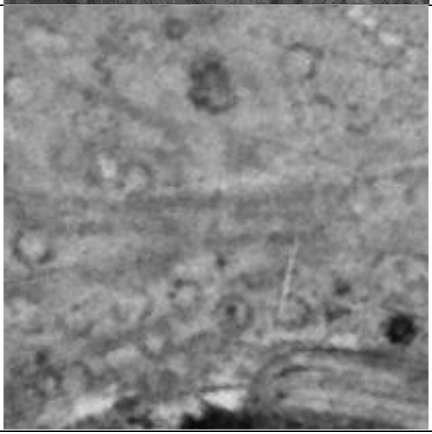


Figure 3-13: The site of Gomish Tappeh on GAMBIT imagery (Left) and CORONA imagery (Right). Notice the difference in resolution (Imagery available from the US Geological Survey).

Table 3-4: Features identified on the GAMBIT Imagery (imagery available from the US Geological Survey).

FEATURE TYPE	DESCRIPTION	SIZE RANGE (DIAMETER)	EXAMPLE
a) Circular or sub-circular enclosures	'Dashed lines' creating an enclosure space.	~13m-332m	
b) Small circular and sub-circular features	1) Lines or clusters of small uniform circles.	~5-10m	
	2) Larger groupings, clusters	~5-10m	

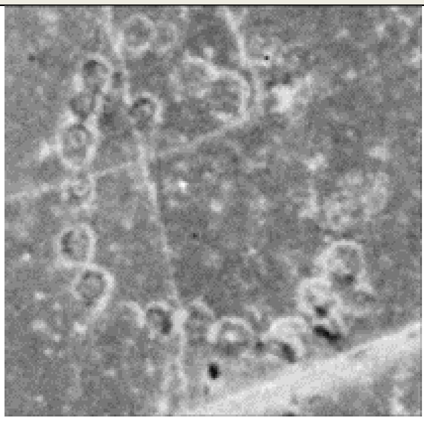
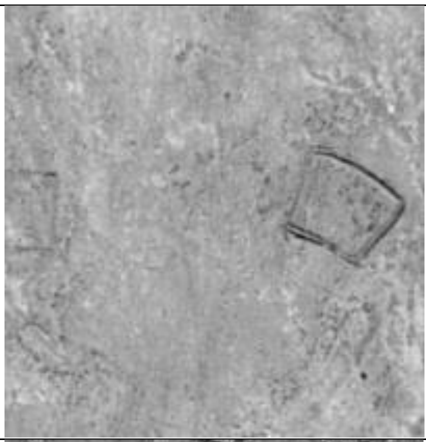
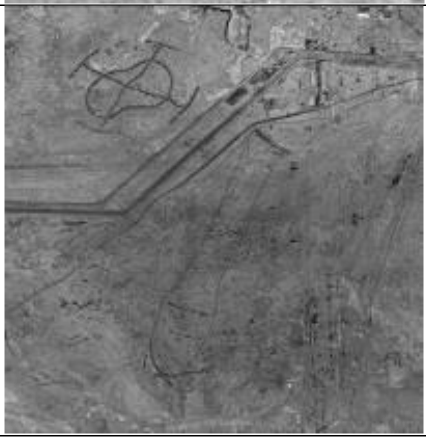
FEATURE TYPE	DESCRIPTION	SIZE RANGE (DIAMETER)	EXAMPLE
	3) Semi-circular clusters and patterns on ridgelines	~10m	
c) Rectilinear Features	Varying shapes, sizes and possible functions.	Variable	
d) Irregular features	Circular and linear features (such as an `x` through a large circle, or series of short parallel lines). Probably modern features. This category does not encompass features with a single distinct morphology.	Variable	

Figure 3-14: Location of features mapped on the GAMBIT imagery. The main feature groupings discussed in the text are indicated.

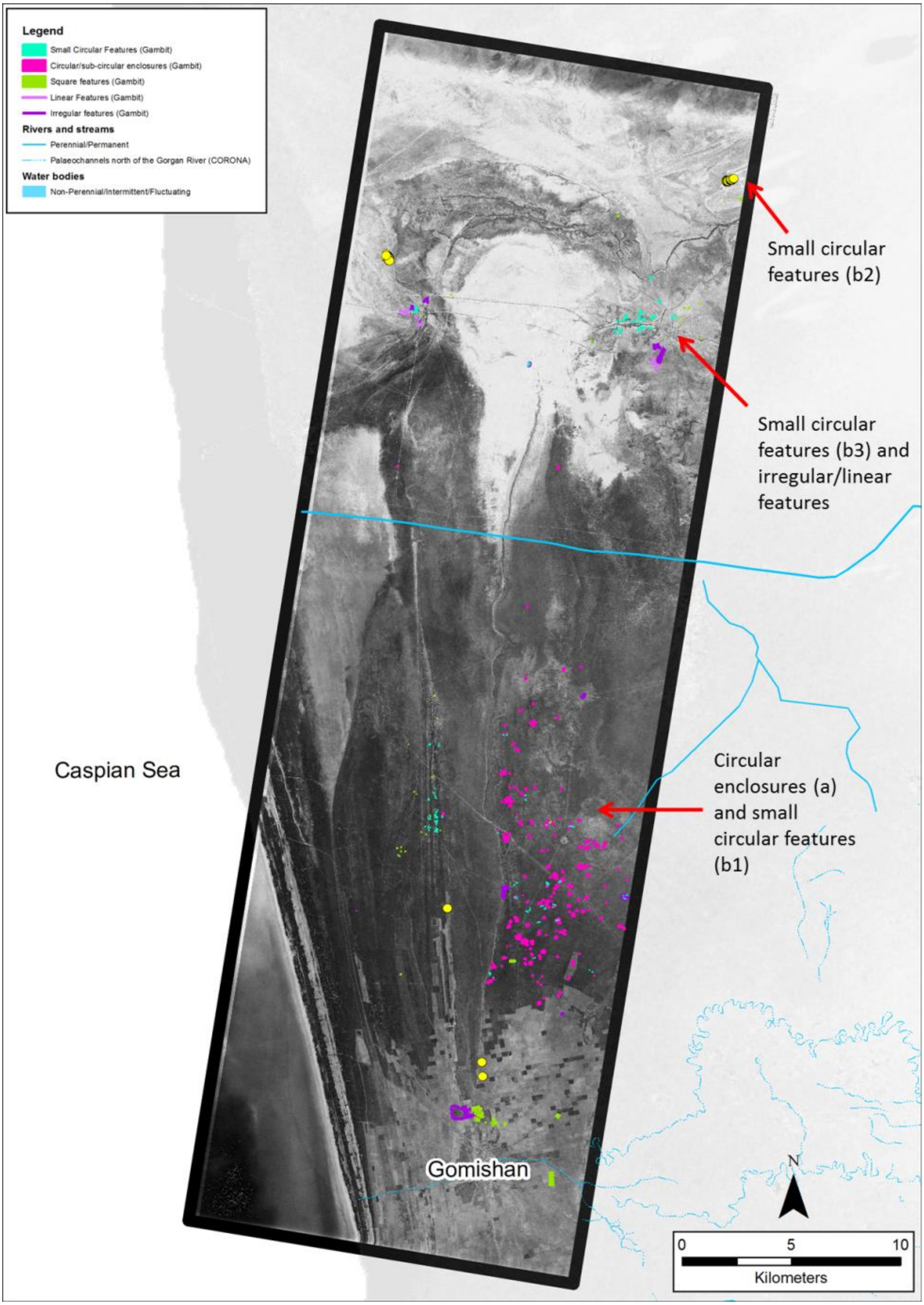


Figure 3-15: Site of Qizlar Qal'eh viewed in Google Earth. The prominent qal'eh is visible in the centre of the image. Low outer mounds are visible to the northwest, north and east. The Gorgan Wall is visible cutting through the southern edge of the site (Imagery CNES/Astrium 2015).

Figure 3-16: SRTM 90m DEM for the Gorgan Plain (Imagery available from the US Geological Survey).

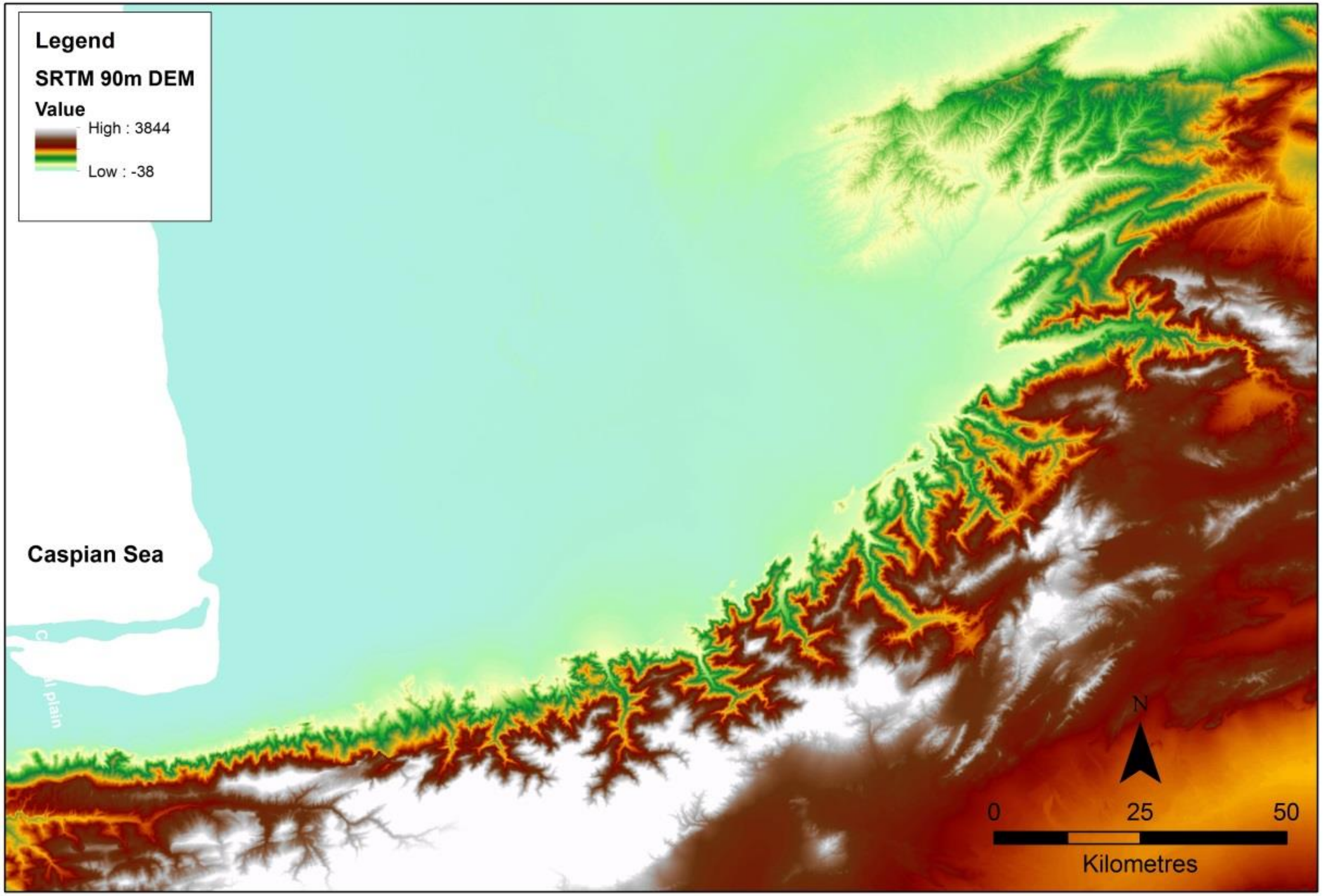


Figure 3-17: Site based survey at Qelich Qoineq – Topographical (left) and geophysical surveys (right). CORONA imagery available from the US Geological Survey. Geophysical survey by Abingdon Archaeological Geophysics and the ICHHTO.

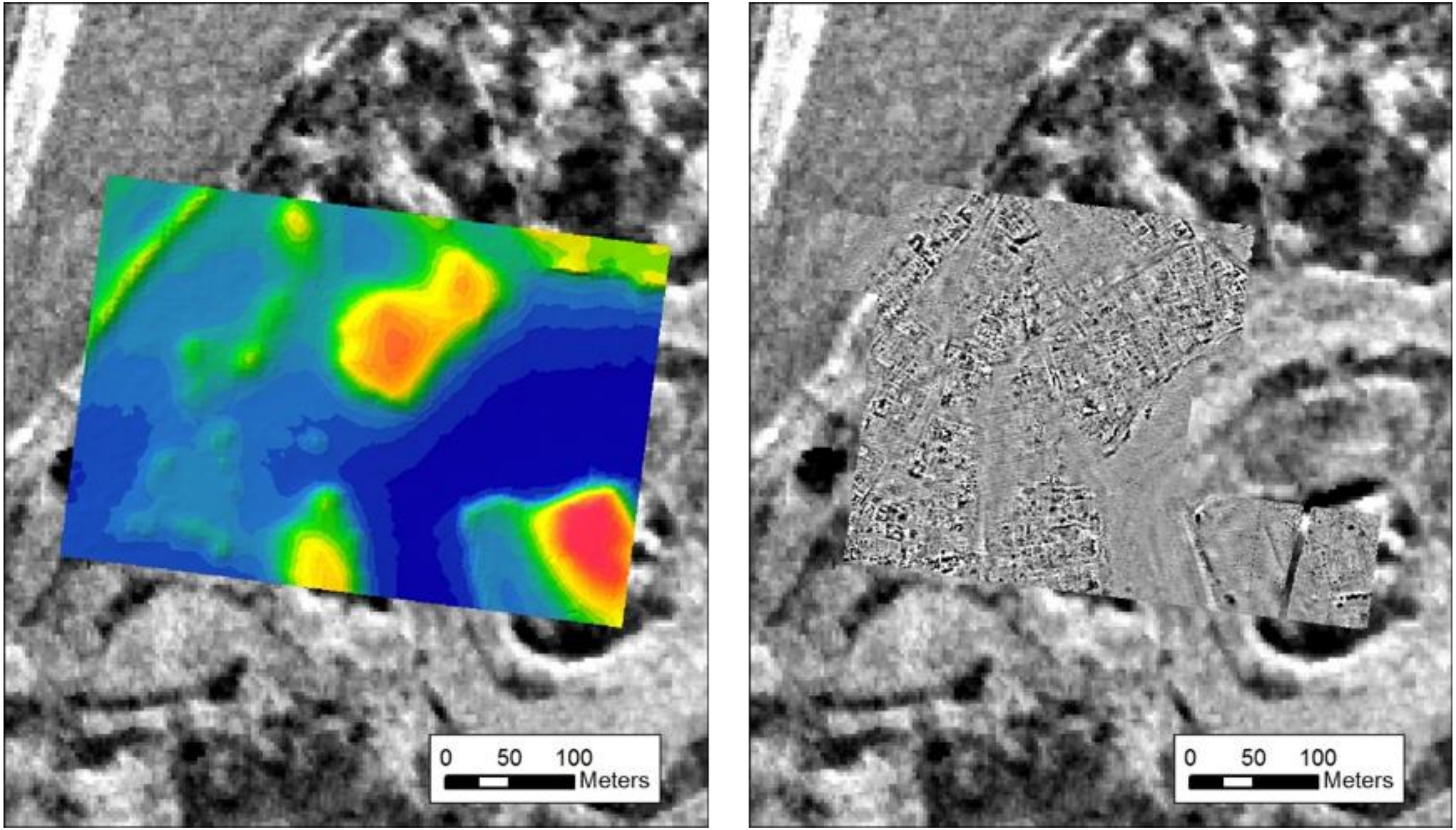


Table 3-5: Survey data used in the Gorgan Plain database.

DATA SOURCE	DATE	AREA COVERED	METHODOLOGY
Archaeological Map of the Turkoman Steppe - Arne 1945	1932-33	c. 2950 km² between the Gorgan Wall and the Alborz Mountains.	All visible tappehs and mounded features were surveyed. Artefact collections made.
Archaeological Map of the Gorgān Plain, Iran No. 1 and 2 - Shiomi 1976; 1978	1974-1978	c. 1880 km²	All visible tappehs and mounded features located during ground survey were recorded. Artefact collections made.
Parthian sites of the Gurgan Plain - Kiani 1982b	Late 1970s	c. 1950 km² along the Gorgan Wall surveyed via aerial photographs. Variable ground coverage.	Guided by aerial photography. Selected site visits and artefact collections made.
ICHHTO site visits - Abbasi 2011	Late 1990s to mid 2000s	c. 20 000 km² of variable coverage	Sites known from published surveys were visited and a GPS coordinate taken.
Gorgan Wall Project Survey (GWP) - Wilkinson et al. 2013	2005-2009	c. 13 000 km² investigated through remote sensing; variable ground coverage.	Guided by satellite imagery and locations of known sites. GPS locations were taken, site extents recorded in field. Artefact collections made.

Table 3-6: Example of the types of observations that can be made on a single site in the database.

MAJOR_ID	CATEGORY	DATA_TYPE	DATA_SOURCE	PERIOD_CODE
ARNE_45_1_0	Literature Reference	Original Survey ID	Arne Survey	
ARNE_45_1_0	Object Data	Pottery	Arne Survey	
ARNE_45_1_0	Object Data	Diagnostic (UNCERTAIN)	Arne Survey	ISL
ARNE_45_1_0	Object Data	comments	Arne Survey	
ARNE_45_1_0	Site Feature	Tepe (tappeh) or Mounded Structure	Arne Survey	
ARNE_45_1_0	Site Feature	Tepe (tappeh) (ovoid)	Arne Survey	
ARNE_45_1_0	Site Feature	Ramparts	Arne Survey	
ARNE_45_1_0	Site Feature	Hydrological Feature	Arne Survey	
ARNE_45_1_0	Site Morphology	Ovoid	Arne Survey	
ARNE_45_1_0	Site Morphology	Dimensions	Arne Survey	
ARNE_45_1_0	Site Morphology	Height 5-10m	Arne Survey	
ARNE_45_1_0	Survey Methodology	Field Visit	Arne Survey	
ARNE_45_1_0	Survey Methodology	Evidence Collected	Arne Survey	
ARNE_45_1_0	Survey Methodology	Spatial unit description	Arne Survey	
ARNE_45_2_0	Site Feature	Tepe (tappeh) or Mounded Structure	C1056	
ARNE_45_2_0	Site Feature	Ramparts	C1056	
ARNE_45_2_0	Site Feature	Hydrological Feature	C1056	
ARNE_45_2_1	Site Feature	Tepe (tappeh) (ovoid)	C1056	
ARNE_45_2_0	Site Morphology	Dimensions	C1056	
ARNE_45_2_1	Site Morphology	Ovoid	C1056	
ARNE_45_2_1	Site Morphology	Dimensions	C1056	

Figure 3-18: The Gorgan Plain Database interface. The database structure was developed for the Homs Regional survey project by Graham Philip and Anthony Beck and adapted by Rob Dunford, Graham Philip, Dan Lawrence and Jennie Bradbury for the Fragile Crescent Project database at Durham University.

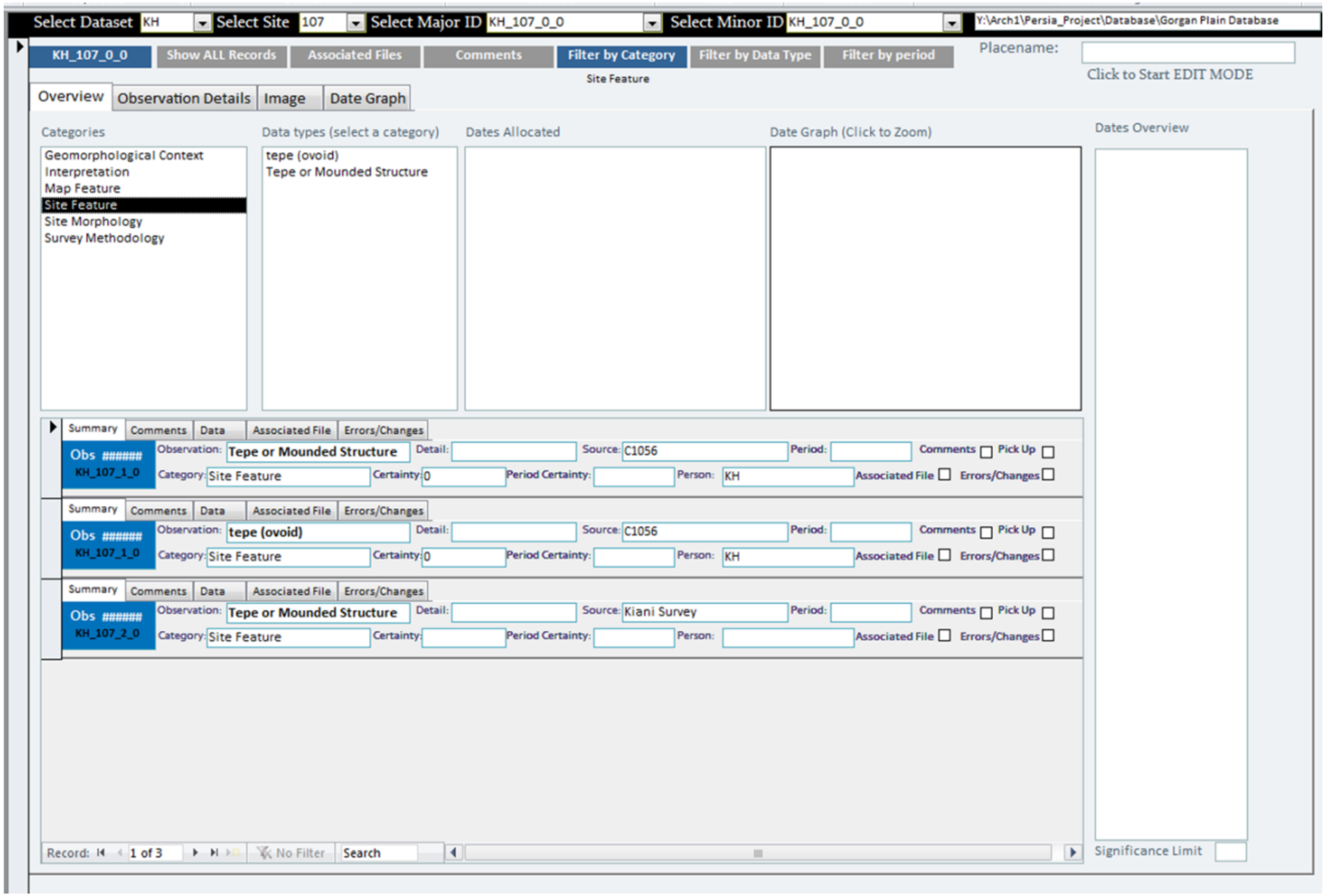


Table 3-7: Archaeological significance for data from imagery following the criteria developed by the FCP. After Lawrence 2012: 3.9.

CATEGORY	DESCRIPTION
High	Type-site clearly visible
Medium	Clear anomaly; crosses field boundaries
Low	Disturbance follows field boundaries; if multiple images used, it may not be visible in all images
Negligible	Probably geological formation, but worth noting

Table 3-8: Assessment of boundary certainty for both data from imagery and field survey following the criteria developed by the FCP. After Lawrence 2012: 3.7.

BOUNDARY CERTAINTY	DATA FROM IMAGERY - EVIDENCE	DATA FROM FIELD SURVEY - EVIDENCE
Definite		• Multiple GPS points and Topographic Map • Multiple GPS points and GIS outline drawn in the field • Multiple GPS points and good quality sketch-map • Multiple GPS points around outline of simple site shape
High	• Clear type site – e.g. Tell • Clear Boundary • Very Similar on multiple images	• 2 or 3 GPS points and Topographic/Topographic-based map • Topographic/Topographic-based map with sufficient information to georectify • 2 or 3 GPS points and good quality sketch-map
Medium	• Fairly Clear Boundary • Fairly Similar on multiple images	• Topographic/Topographic-based map • Good quality sketch-map with dimensions
Low	• Diffuse Boundary • Different on images	• Good quality sketch-map only • Dimensions only • Overall sites map suggests site sizes, no other information
Negligible	• Very Diffuse • Very different on different images	• General area description only • Overall sites map with locations only

Table 3-9: Geographical precision for field derived data following the criteria developed by the FCP. After Lawrence 2012: Table 3.4.

GEOGRAPHICAL PRECISION	EVIDENCE
Definite	• Multiple GPS points • GIS outline drawn in the field
High	• Sites accurately drawn on well rectified topographic map • Single GPS point
Medium	• Rectified general sites map based on topographic map
Low	• General sites sketch map only • General sites map with insufficient detail to rectify to acceptable levels of accuracy
Negligible	• Text description only

Table 3-10: Categories resulting from combinations of boundary certainty and geographical precision.

BOUNDARY CERTAINTY	GEOGRAPHICAL PRECISION	CATEGORY NUMBER
High	High	1
Medium	High	2
Medium	Low	3
Medium	Negligible	4
Low	High	5
Low	Low	6
Low	Negligible	7
Negligible	Medium	8
Negligible	Low	9
Negligible	Negligible	10

Table 3-11: Boundary certainty and geographical precision definitions for the Arne 1945 survey data (following the FCP criteria, defined in Lawrence 2012: Tables 3.4, 3.7 and 3.9)

	NO. OF SITES	BOUNDARY CERTAINTY	GEOGRAPHICAL PRECISION
Category 3	157	Medium • Good quality sketch map with dimensions	Low • General sites map with insufficient detail to rectify to acceptable levels of accuracy
Category 6	64	Low • Dimensions only	Low • General sites map with insufficient detail to rectify to acceptable levels of accuracy
Category 9	128	Negligible • Overall site map with locations only	Low • General sites map with insufficient detail to rectify to acceptable levels of accuracy
	28	Negligible • General area description only	Low • General sites map with insufficient detail to rectify to acceptable levels of accuracy

Table 3-12: Sites from the Arne 1945 dataset mentioned only in the text, and buffer distance applied to create a spatial record.

NAME	MAJOR_ID	LOCATION	BUFFER
unknown_text_01	ARNE_242_1_0	NE of Yarimtepe (86)	0.5km
unknown_text_02	ARNE_243_1_0	180m WSW of Qaladjik (43) fixed point	0.18km
unknown_text_03	ARNE_244_1_0	Near Gobektepe (49)	0.5km
unknown_text_04	ARNE_245_1_0	NW of Tepe Aghac (57)	0.5km
unknown_text_05	KH_96_3_1	NE of Djafar tepe (61) 200m away	0.2km
unknown_text_06	ARNE_46_3_0	Near Karakhan tepe (66)	0.5km
unknown_text_07	ARNE_246_1_0	Near Derman tepe 1 (69)	0.5km
unknown_text_08	ARNE_247_1_0	Between Pokhlu tepe I & II	0.5km from centroid between I & II
unknown_text_09	ARNE_248_1_0	North of Qarinyarki tepe (118)	0.5km
unknown_text_10	ARNE_249_1_0	Near Qok Tepe (Q); west of old river bed	0.5km
unknown_text_11	GWS_32_3_0	400m to NW of Saltandun (42)	0.4km
unknown_text_12	ARNE_34_3_1	In the vicinity of Without name (48)	0.5km
unknown_text_13	ARNE_250_1_0	90m away from Kaplan Tepe (94)	0.09km
unknown_text_14	KH_70_3_1	270m from Haleglic I (100)	0.27km
unknown_text_15	KH_70_4_1	250m from Haleglic I (100)	0.25km

NAME	MAJOR_ID	LOCATION	BUFFER
unknown_text_16	ARNE_251_1_0	Near Without Name (105)	0.5km
unknown_text_17	ARNE_252_1_0	Near Without Name (104)	0.5km
unknown_text_18	GWS_55_4_0	To west of Without Name (112) in front of entrance	0.5km
Doureh colony I	ARNE_253_1_0	Near Doureh tepe 1 (114)	0.5km
157 Agh Meše	ARNE_256_1_0	10km buffer zone based on centroid of cluster of sites in the numeric sequence before and after 157 in the survey catalogue.	10km
158 Qala	ARNE_257_1_0	10km buffer zone based on centroid of cluster of sites in the numeric sequence before and after 158 in the survey catalogue.	10km
177 Qoša tepeler	ARNE_255_1_0	No indication of targeted location based on sites in the numeric sequence before and after 177 the survey catalogue.	Entire survey area
186 Qarinyarik	ARNE_254_1_0	10km buffer zone based on centroid of cluster of sites in the numeric sequence before and after 186 in the survey catalogue.	10km
Without name (middle 27)	ARNE_241_1_0	Between Dourek tepe, Kara tepe and AqÞir Tepe	0.5km from centroid between sites

Table 3-13: Assessment of boundary certainty and geographical precision for the Hiroshima University surveys (Shiomi 1976, 1978) (following the FCP criteria, defined in Lawrence 2012: Tables 3.4, 3.7 and 3.9).

	NO. OF SITES	BOUNDARY CERTAINTY	GEOGRAPHICAL PRECISION
Category 2	202	Medium • Good quality sketch of each site on a topographic based map • Text description with dimensions	High • Sites accurately drawn on well rectified topographic map
Category 5	4	Low • Good quality sketch map only	High • Sites accurately drawn on well rectified topographic map
Category 6	20	Low • Overall sites map • Text descriptions with dimensions	Low • General sites map with insufficient detail to rectify to acceptable levels of accuracy
Category 7	2	Low • Dimensions only	Negligible • Text description only

Table 3-14: Assessment of boundary certainty and geographical precision for the Kiani Survey (1982b (following the FCP criteria, defined in Lawrence 2012: Tables 3.4, 3.7 and 3.9).

	NO. OF SITES	BOUNDARY CERTAINTY	GEOGRAPHICAL PRECISION
Category 1	45	High • Sites drawn on map based on aerial photographs, georectified to the CORONA imagery **AND** • Scale drawing/ground plan **AND/OR** • Text description with dimensions	High • Sites drawn on map based on aerial photographs, georectified to the CORONA imagery
Category 2	83	Medium • Sites drawn on map based on aerial photographs, georectified to the CORONA imagery	High • Sites drawn on map based on aerial photographs, georectified to the CORONA imagery
Category 3	7	Medium • Scale drawing • Text description with dimensions	Low • General sites map with insufficient detail to rectify to acceptable levels of accuracy
Category 4	1	Medium • Scale drawing • Text description with dimensions	Negligible • Text description of location only
Category 6	6	Low • Scale drawing **OR** dimensions only	Low • General sites map with insufficient detail to rectify to acceptable levels of accuracy
Category 7	1	Low • Scale drawing only **OR** dimensions only	Negligible • No information
Category 9	5	Negligible • Overall sites map with locations only	Low • General sites map with insufficient detail to rectify to acceptable levels of accuracy
Category 10	4	Negligible • No information	Negligible • Text description of location only
TOTAL NUMBER OF SITES	152[1]		

[1] There are actually 154 sites recorded in Kiani's (1982b) survey from various sources, two sites (Forts 3 and 11) however have since been proven to not be of archaeological significance (see Sauer et al. 2013).

Table 3-15: Assessment of boundary certainty and geographical precision for the Iranian surveys (Abbasi 2011) (following the FCP criteria, defined in Lawrence 2012: Tables 3.4, 3.7 and 3.9).

	NO. OF SITES	**BOUNDARY CERTAINTY**	**GEOGRAPHICAL PRECISION**
Category 8	566	Negligible • Overall sites map with locations only	Medium • Rectified general sites map based on topographic map

Figure 3-19: Section of map of northeast Iran including the Gorgan Plain depicting tribal areas, wells, routes etc. After Baker 1876.

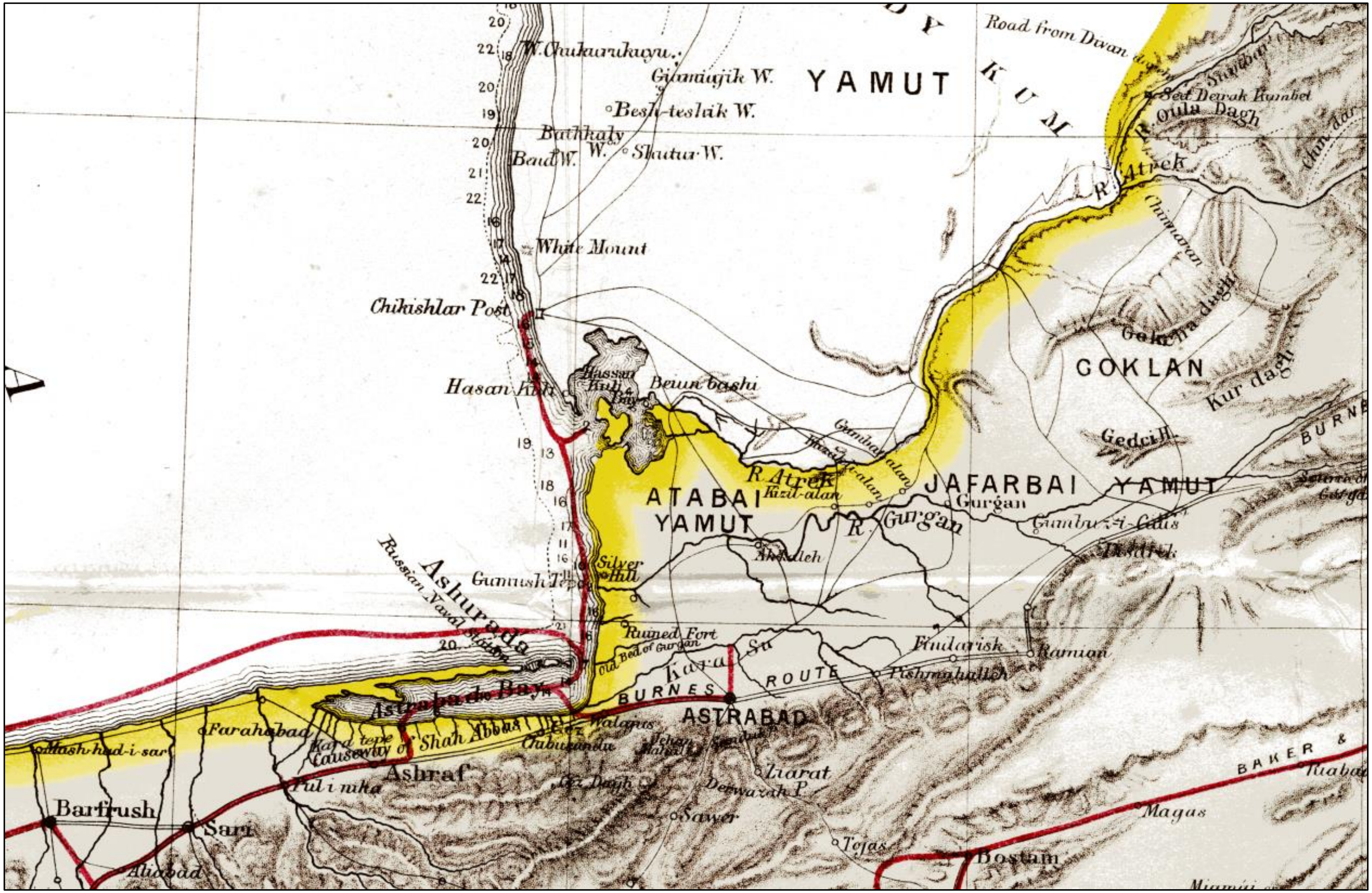


Figure 3-20: Section of map depicting the Gorgan Plain. Notice the Gorgan Wall. After Muraviev 1871.

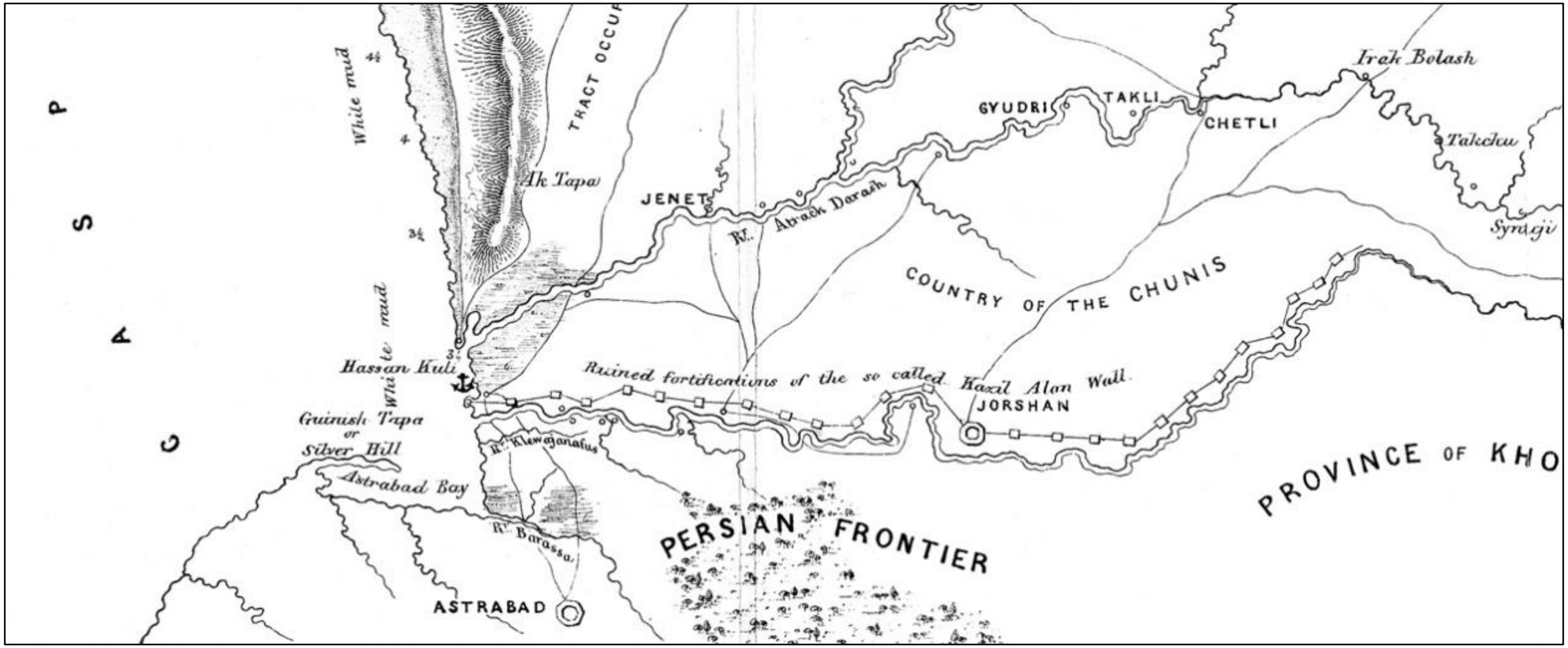


Figure 3-21: Section of map depicting the Gorgan Plain. After Napier and Ahmed 1876.

Image redacted due to copyright

4. CHRONOLOGY

Figure 4-1: Map indicating sites mentioned in the discussion of chronological information for the greater region.

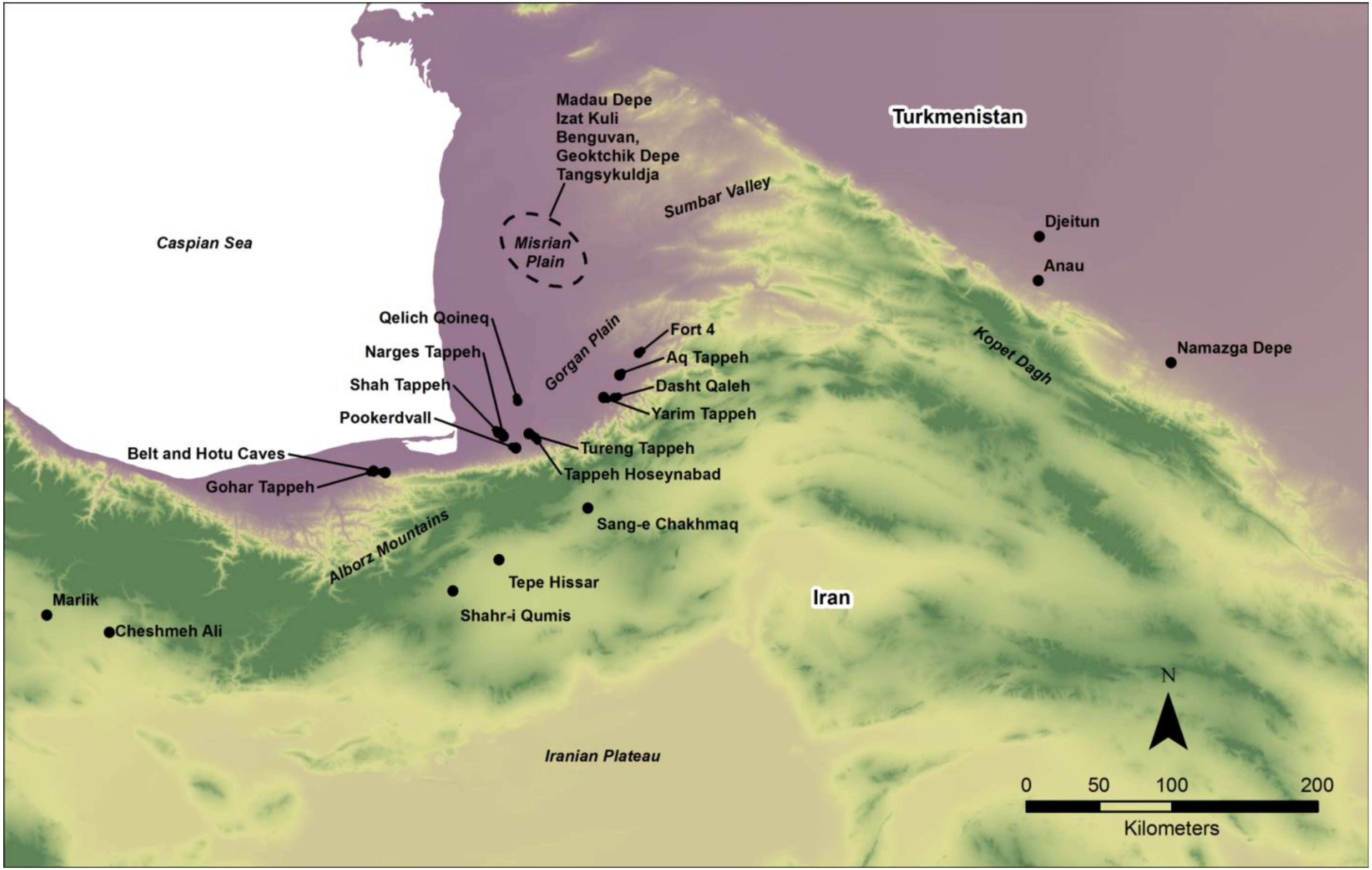


Table 4-1: Relative Chronology of the Gorgan Plain (data from Boucharlet & Lecomte 1987; Kohl 1984; Priestman 2013; Thornton 2013b).

DATE	PERIOD	COMMENTS
6500		
		Ali Tappeh B
	Epipalaeolithic/ Mesolithic	
		Belt/Hotu Caves
6000	Early Ceramic Neolithic	
		Aq Tappeh
		Yarim 1
5500	Late Ceramic Neolithic	
		Tureng Tappeh I A
	Early Chalcolithic	
5000		
		Hotu Cave, Belt Cave
		Tureng Tappeh I B
4500		

DATE	PERIOD	COMMENTS
4000		
	Late Chalcolithic	
		Shah Tappeh III
		Tureng Tappeh II A
		Early Yarim Tappeh II
3500		
		Shah Tappeh III-III B
		Tureng Tappeh II B
		Late Yarim Tappeh II
3000		
	Early Bronze Age	Tureng Tappeh III A
		Tureng Tappeh III B
		Shah Tappeh IIB
2500		Early Yarim Tappeh III
	Middle Bronze Age	Tureng Tappeh III C 1
2000		Shah Tappeh II A
		Late Yarim Tappeh III

DATE	PERIOD	COMMENTS
	Late Bronze Age	Tureng Tappeh III C 2
1500		
	Iron I?	?
1000	Iron II?	?
	Iron III	Occupation at Trench P at Qelich Qoineq falls within this phase Contemporary with part of Tureng Tappeh IV A Contemporary with part of the Archaic Dehistan phase in the Misrian Plain of Turkmenistan
500 BC	Iron IV	Iron IV includes post-Qelich Qoineq to the early Parthian (?) period. Encompasses several ceramic phases (probably includes ceramics from Tureng Tappeh IV B – VA)
	Parthian	Tureng Tappeh V B – V C
0		
1		Tureng Tappeh final V C – V D
2		
3	Early Sasanian	Tureng Tappeh VI
4	Late Sasanian	Qaleh Kharabeh Fort 4
AD 500		

DATE	PERIOD	COMMENTS
6		Tureng Tappeh VII A/B
	Early Islamic	
7		
		Tureng Tappeh VII C ?
8		
9		
1000		

Figure 4-2: Burnished grey wares of the Bronze Age from Yarim Tappeh. From the collections of the Metropolitan Museum of Art (Clockwise from top left EBA jar with incised decoration (http://www.metmuseum.org/art/collection/search/325598); MBA vase (http://www.metmuseum.org/art/collection/search/325596); MBA carinated vase (http://www.metmuseum.org/art/collection/search/325594); MBA beaker (http://www.metmuseum.org/art/collection/search/325595).

Figure 4-3: Late Bronze and Early Iron Age Ceramics from Parkhai Depe in the Sumbar Valley, Turkmenistan. a) Ceramics from the grave 14 - After Chlopin 1973: Fig. 19; b) Ceramics from the settlement of Parkhai Depe - After Chlopin 1973: Fig 6; C) Ceramics from the settlement of Parkhai Depe - After Chlopin 1973: Fig. 11.

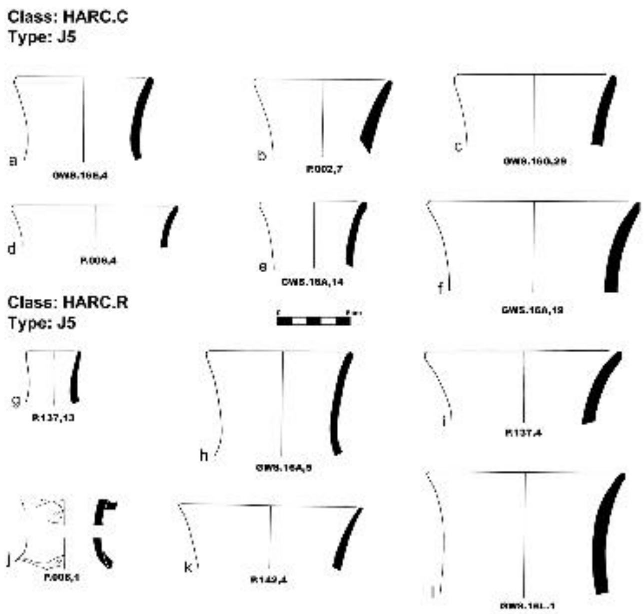
Image redacted due to copyright

Figure 4-4: Late Bronze Age (a) and Early Iron Age (b) pottery from Gohar Tappeh. Ceramics are from burial contexts. After Mahfroozi and Pillar 2009: Fig. 8 and Fig. 14.

Image redacted due to copyright

Figure 4-5: Iron III Pottery from excavations at Qelich Qoineq. From Left to Right – HARC.R (After Sauer et al. 2013: Plate 18:25), HARC.G (after Sauer et al. 2013: Plate 18:26), and HARC.C (after Sauer et al. 2013: Plate 18:26).

Figure 4-6: Pitchers and Jugs - A –Qelich Qoineq (after Priestman 2013: Fig. 18:27 a-f (cream ware), g-l (red ware)); B –Benguvan (after Murdova 1991: 12-13); C – Tureng Tappeh IVA (after Cleuziou 1985: Fig. 7: 1,3-6 (red ware), 2, 7-8 (cream ware)); D – Tureng Tappeh IVA (after Cleuziou 1985: Fig. 9: 1 (Grey/black), 2-4 (red ware)).



A

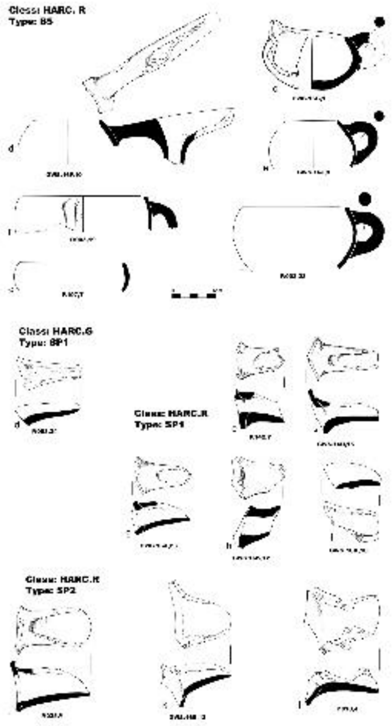
Image redacted due to copyright

Image redacted due to copyright

B

Image redacted due to copyright

Figure 4-7: Spouted and handled vessels - A –Qelich Qoineq (after Priestman 2013: Fig. 18:23 a (grey ware), b (cream ware), c-h (red ware)); B –Qelich Qoineq (after Priestman 2013: Fig. 18:26 d (grey ware), e-i (red ware)); C - selection from Archaic Dehistan Sites - Tangsykuldja, Isat kuli, Madau depe (after Cleuziou 1986: fig. 5)): D – Benguvan (after Murdova 1991: 12-13); E – Tureng Tappeh IVA (after Cleuziou 1985: Fig. 8: 1-3, 5-9 (red ware), 11 (grey/black ware), 4, 10 (course ware).



A

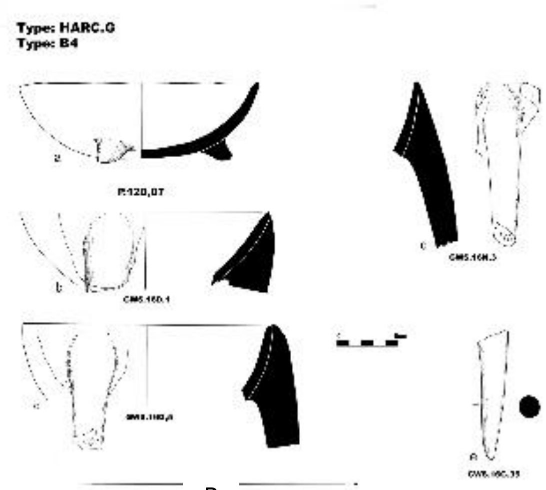
B

Image redacted due to copyright

Image redacted due to copyright

Figure 4-8: Tripod Bowls – A - Tureng Tappeh IVA (after Cleuziou 1985: Fig. 6. 1-2 (red ware)); B –Qelich Qoineq (after Priestman 2013: Fig. 18:22 a-e (Grey ware)); C –Benguvan (Misrian Plain) (after Murdova 1991: 12-13); D – Unspecified Archaic Dehistan site on the Misrian Plain (after Cleuziou 1986: fig. 5).

Image redacted due to copyright



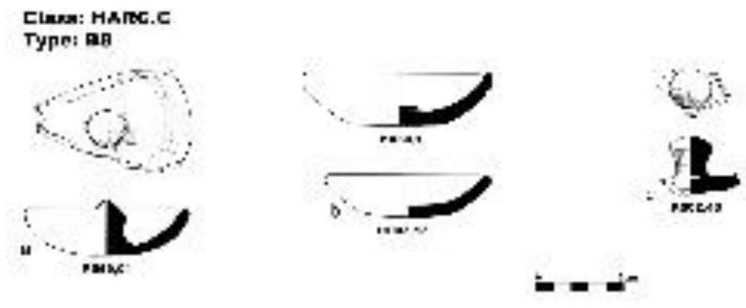
B

Image redacted due to copyright

Image redacted due to copyright

Figure 4-9: “lids” – a – Tureng Tappeh IVA (after Cleuziou 1985: Fig. 11 (cream ware)); B – Qelich Qoineq (after Priestman 2013: Fig. 18:26 a-c (cream ware)); C – Unspecified Archaic Dehistan site in the Misrian Plain (after Cleuziou 1986: Fig. 5).

Image redacted due to copyright



B

Image redacted due to copyright

Figure 4-10: A,B – Buff Ceramics from Tureng Tappeh IV B (after Cleuziou 1985: Fig 18 & 19).

Image redacted due to copyright

Figure 4-11: Ceramics from Period VA at Tureng Tappeh (after Cleuziou 1985: Fig. 24: 2,5,8-9 (red ware), 3-4, 6-7 (red with "flame" aspect – i.e. bichrome ware), 1 (brown ware).

Image redacted due to copyright

Figure 4-12: Bichrome wares – A – Yarim Tappeh (After Crawford 1963: Fig. 9; *www.metmuseum.org*); B – Tureng Tappeh (After Besenval 1987, *Mesopotamia*: Figs. 107a, 112a).

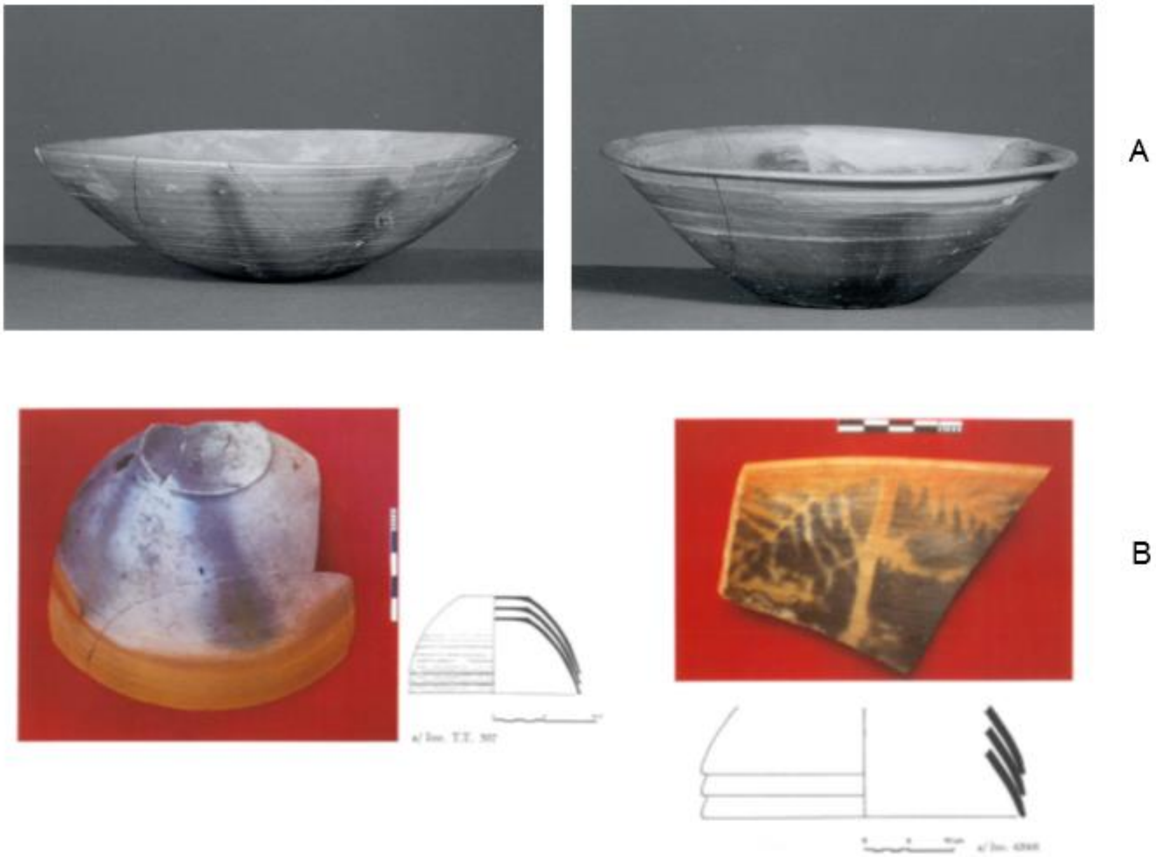


Figure 4-13: Ceramique noire or black ware – Tureng Tappeh (after Besenval 1987, *Mesopotamia*: Fig. 106 a, b

Figure 4-14: Selection of Tureng Tappeh VC Final to VD Ceramics - A – After Boucharlet & Lecomte 1987: Pl. 42. 1-3, 11-12; B – After Boucharlet & Lecomte 1987: Pl. 41: 8-12; C- After Boucharlet & Lecomte 1987: Pl 45. 1-9; D – After Boucharlet & Lecomte 1987: Pl 43 1-8.

Image redacted due to copyright

Figure 4-15: Early Sasanian from Tureng Tappeh. A – After Boucharlet & Lecomte 1987: Pl. 54. 1-5, 14, 15; B – After Boucharlet & Lecomte 1987: Pl. 52.1-4; C – After Boucharlet & Lecomte 1987: Pl. 60. 1-4, 8-9; D – After Boucharlet & Lecomte 1987: Pl. 48.4; E – After Boucharlet & Lecomte 1987: Pl. 58.1-2.

Image redacted due to copyright

Figure 4-16: Mid to Late Sasanian pottery from the Gorgan Plain. REDBUR (After Priestman 2013: Fig. 18.5 (abcde), Fig. 18.3 (ad) and Plates 18.1 and 18.2); REDPLI (After Priestman 2013: Fig. 18.4 (bdf), 18.3 (L), 18.8 (mnpq) and Plate 18.6).

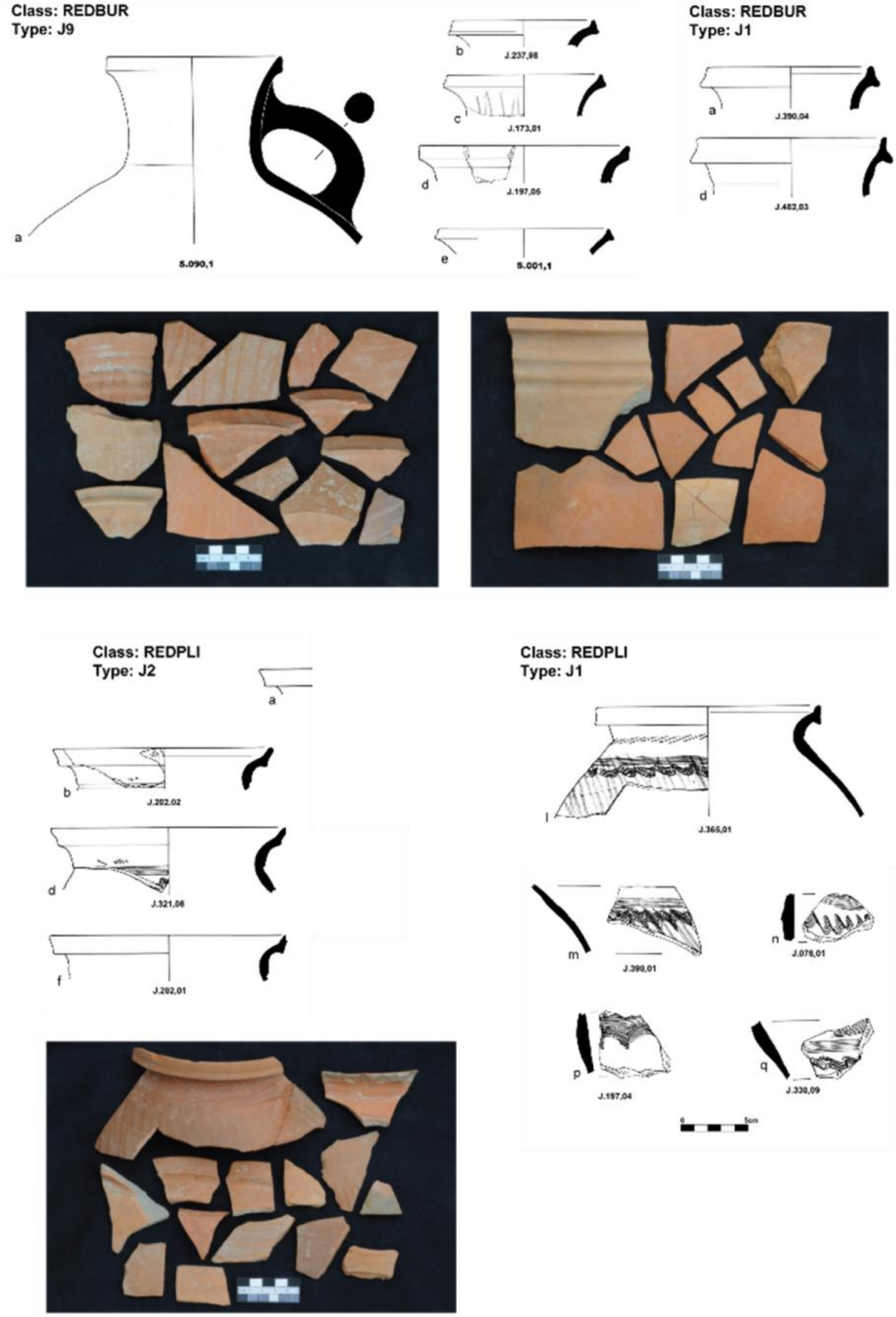
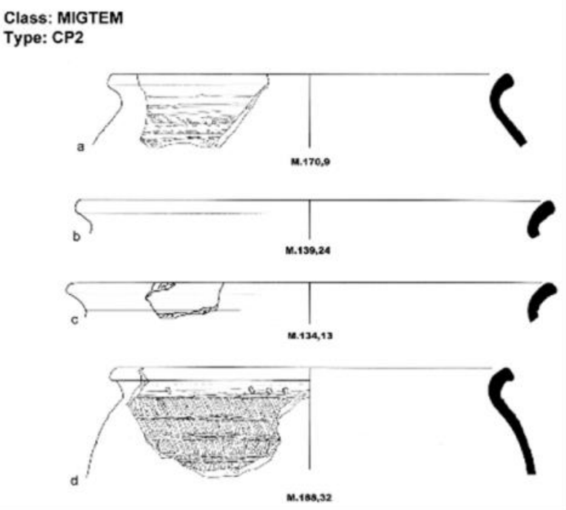
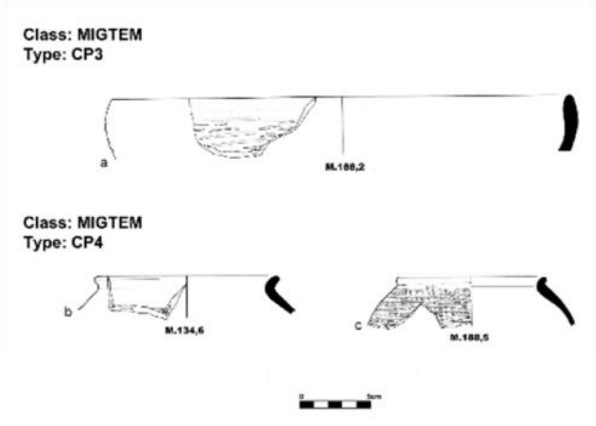
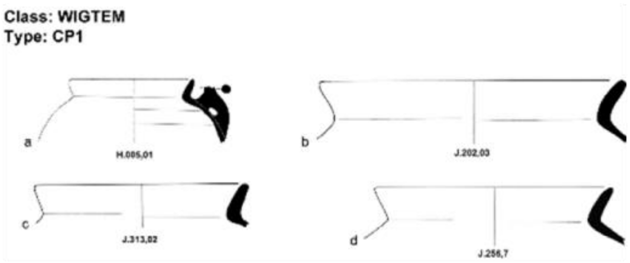


Figure 4-17: Mid to Late Sasanian period cooking pots from the Gorgan Plain. MIGTEM (After Priestman 2013: Fig. 18.19 abcd, Plate 18:14); WIGTEM (After Priestman 2013: Fig. 18:15 abcdi, Plate 18:13).







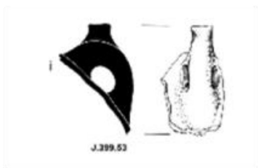


Figure 4-18: Tureng Tappeh VII A/B. A – After Boucharlet and Lecomte 1987: Pl. 66. 3-5; B – After Boucharlet and Lecomte 1987: Pl. 69; C – After Boucharlet and Lecomte 1987: Pl. 67; D – After Boucharlet and Lecomte 1987:Pl. 64. 3-5.

Image redacted due to copyright

Figure 4-19: Objects from Pit F 731 characteristic of Tureng Tappeh VII C. After Boucharlet and Lecomte 1987 Fig. 19.

Image redacted due to copyright

Table 4-2: Pottery types identified by Kiani (1982b: 62-65).

PERIOD	NAME	PARALLELS	COLOUR/FABRIC ETC.	DECORATION	VESSEL TYPES/CHARACTERISTICS	LOCATION
5th millennium			Dark grey; Handmade, very hard	Incised, scratched lines	"Low rim, low ring base, globular body"	"mainly to the west of Jurjan and south of the Barrier, e.g., at Gug Qal'eh"
c. 3500 BC	Black on red painted ware	Shah Tappeh III	Black on red painted ware; thick paste; paint is dark brown to black	Geometric		"to the north-east of Gurgan, close to the end of the Barrier, manily at Qarah Sikh Tappeh and sometimes along Gorgan River"
c. 1000 BC to Parthian Period	Grey ware	Turkmenistan, Yarim Tappeh, Tureng Tappeh, and Shah Tappeh.	Grey			Ubiquitous across plain
Achaemenid		Tureng Tappeh level VA	Grey and red paste; simple grey wares; burnishing	Incised and moulded patterns	Animal figures; rhytons; "cups, jars with handles, AND vessels with zoomorphic shapes"; tripod bases	"mainly in the vicinity of Gorgan River"
Middle Parthian	Grey ware	Tureng Tappeh V C, Yarim Tappeh 1-4, Shahr-I Qumis	Grey; paste dark to light grey	Very few examples	"bowls, pitchers, jugs, and 'teapot' vessels"; "convex bases, globular bodies"	Ubiquitous across plain
4th century BC to Parthian Period	'Clinky ware'		Brown, red, orange; flame or bichrome; thin walls, levigated clay	Burnishing	"bowls, jars, plates, and small cups with handles"	Ubiquitous across plain; from excavations of the wall and Dasht Qal'eh
Early Parthian to Early Sasanian			Dark red; hard paste		"large jars, bowls, deep plates, and ewers"	Ubiquitous across plain

PERIOD	NAME	PARALLELS	COLOUR/FABRIC ETC.	DECORATION	VESSEL TYPES/CHARACTERISTICS	LOCATION
Early Sasanian to Early Islamic	Glazed ware			Turquoise, blue, green; alkaline glaze	“pilgrim flasks, bowls, and large storage jars, with globular bodies and everted rims”	
Sasanian	Simple red ware		Red paste; “usually heavily pitted”		“large jars, jugs, and different types of bowls with thick bodies, everted rims”	
Middle Sasanian to Early Islamic	Incised Red Ware		Red	Incised or stamped on shoulders; decorated with “heavy lines, geometrical patterns, rosettes and sometimes Pahlavi inscriptions”.	“jars, deep bowls, and ewers with flat bases, globular bodies, everted rims and vertical handles”	

5. LANDSCAPES OF THE GORGAN PLAIN

Figure 5-1: Geomorphology and topography (data derived from the 'Regional Map of Land Resources and Potentialities: Gorgan Region – East Mazanderan 1968'). Base map SRTM 90m DEM (Data available from the US Geological Survey).

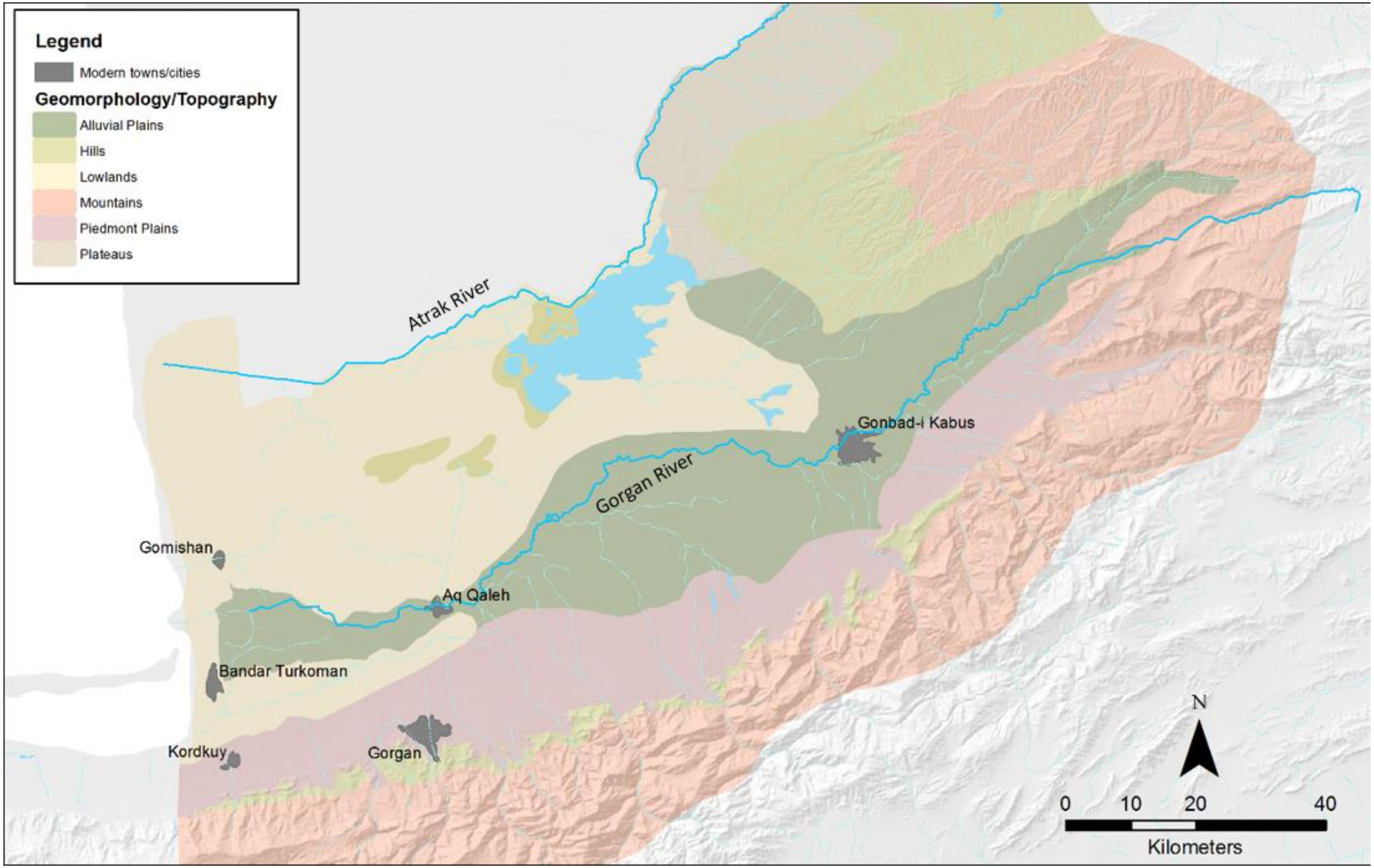


Figure 5-2: Mean annual rainfall (mm) for the Gorgan region. Data from TAVO Map A IV 4 “Middle East Mean Annual Rainfall and Variability”.

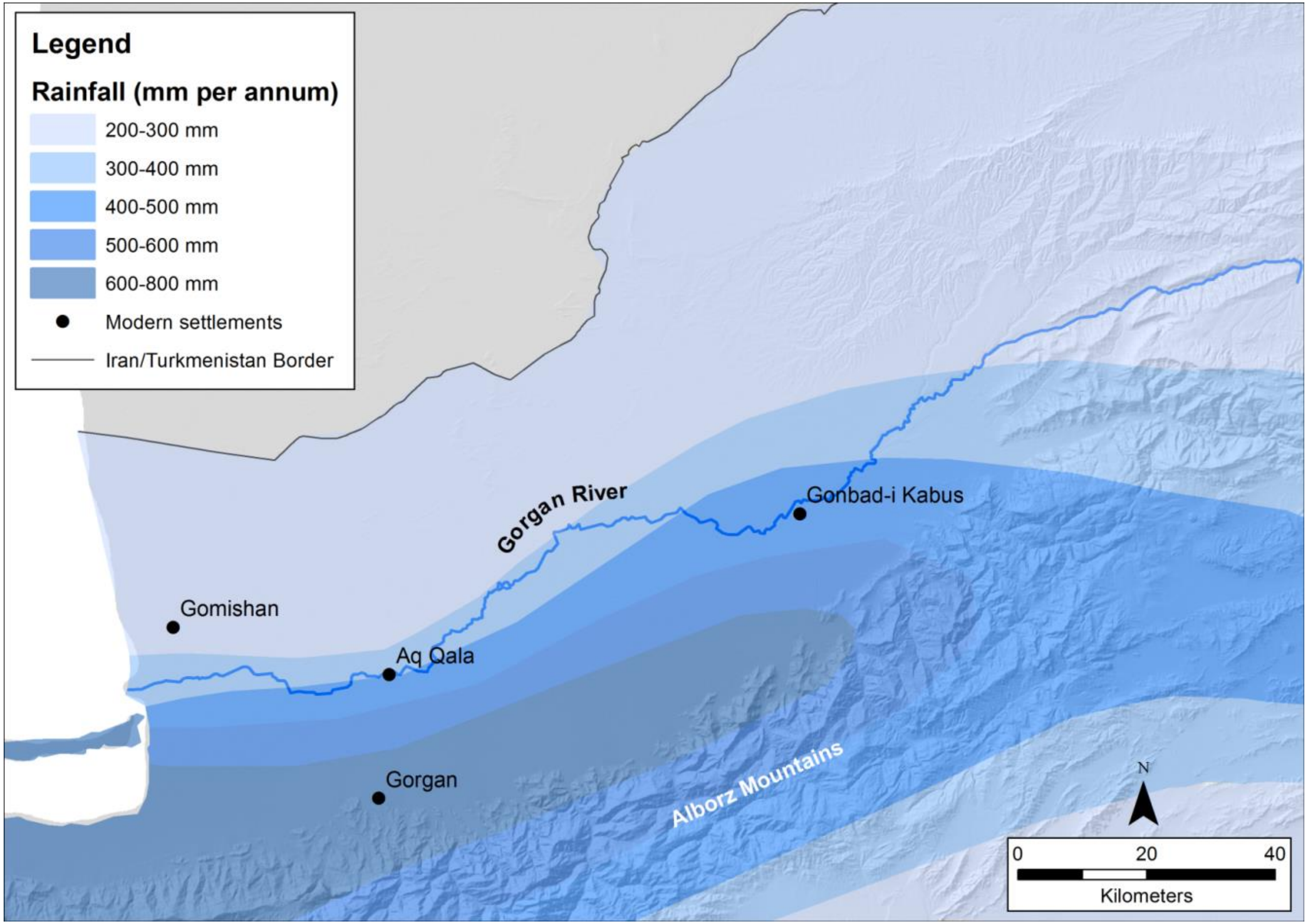


Figure 5-3: Land use and environmental zones (data derived from the 'Regional Map of Land Resources and Potentialities: Gorgan Region – East Mazanderan 1968'). Base map SRTM 90m DEM(Data available from the US Geological Survey).

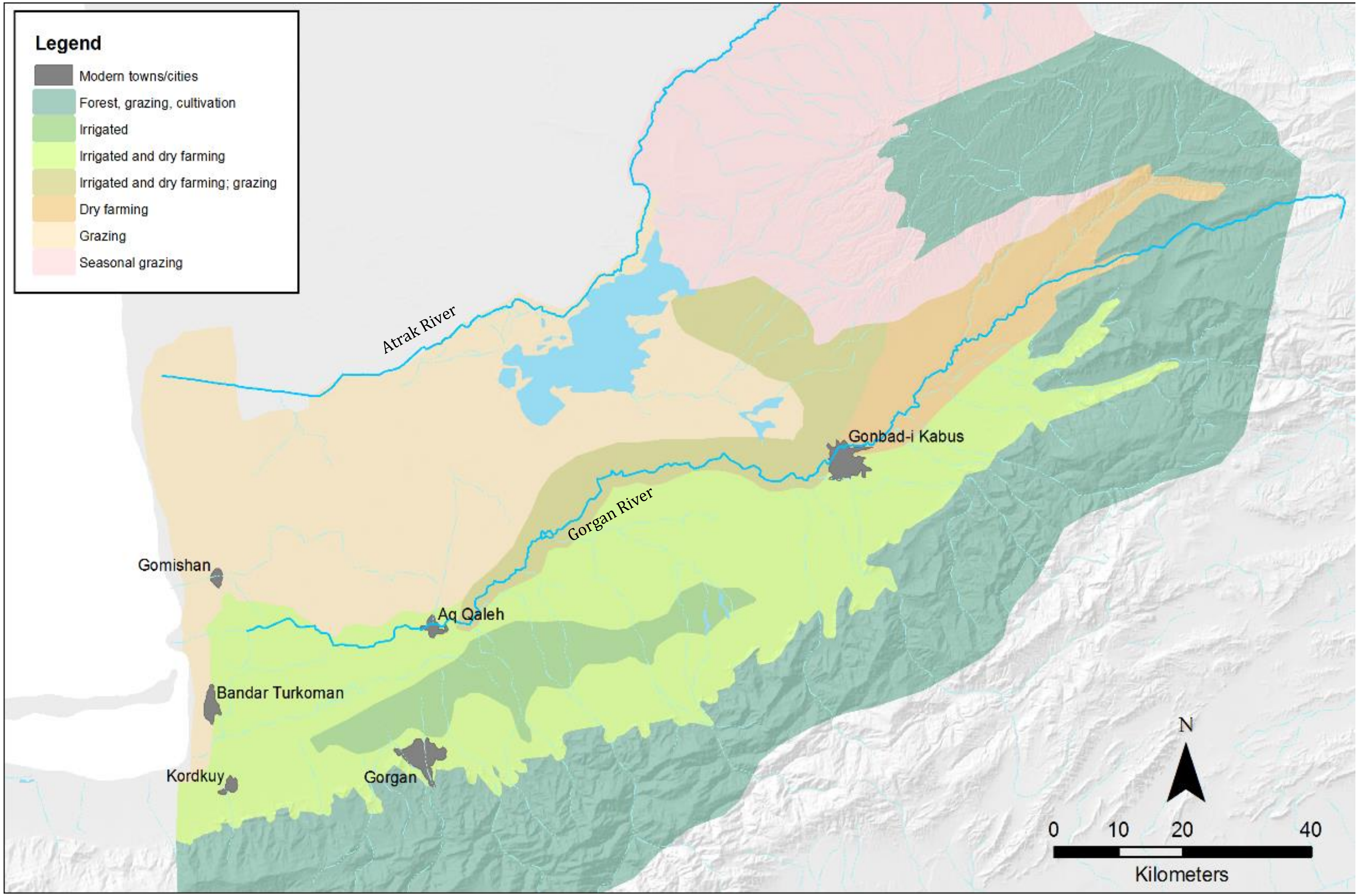


Figure 5-4: Land-use pre-1950 compared to the present day. The dotted lines represent the approximate limits of ecological zones defined by Irons (1974: 638) in reference to subsistence practices in different geographical areas prior to 1950. Zone A is the intensive agriculture zone below the foothills of the Alborz Mountains; Zone B is the extensive agricultural zone that corresponds to the steppe; Zone C is the steppe-desert zone which pastoralism was the main land use strategy. By comparing these zones to the CIR image from 2000/2001 (base map) one can see the northward spread of irrigated agriculture that has occurred since the 1950s particularly to the north of the Gorgan River and in the eastern plain (Landsat imagery available from the US Geological Survey).

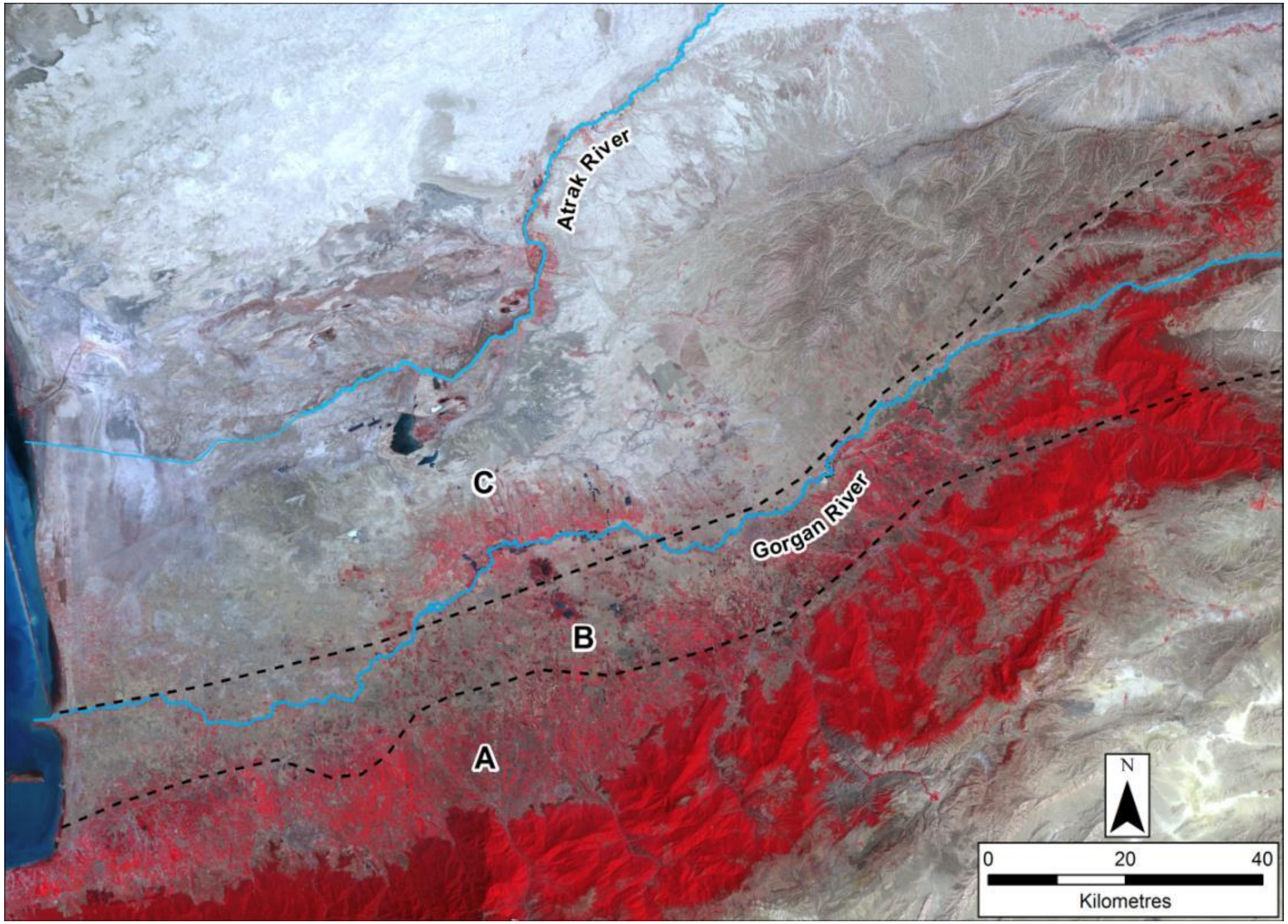


Figure 5-5: Coverage of archaeological surveys undertaken in the Gorgan Plain. Intensity of coverage varies both within the survey areas for individual surveys, and between surveys.

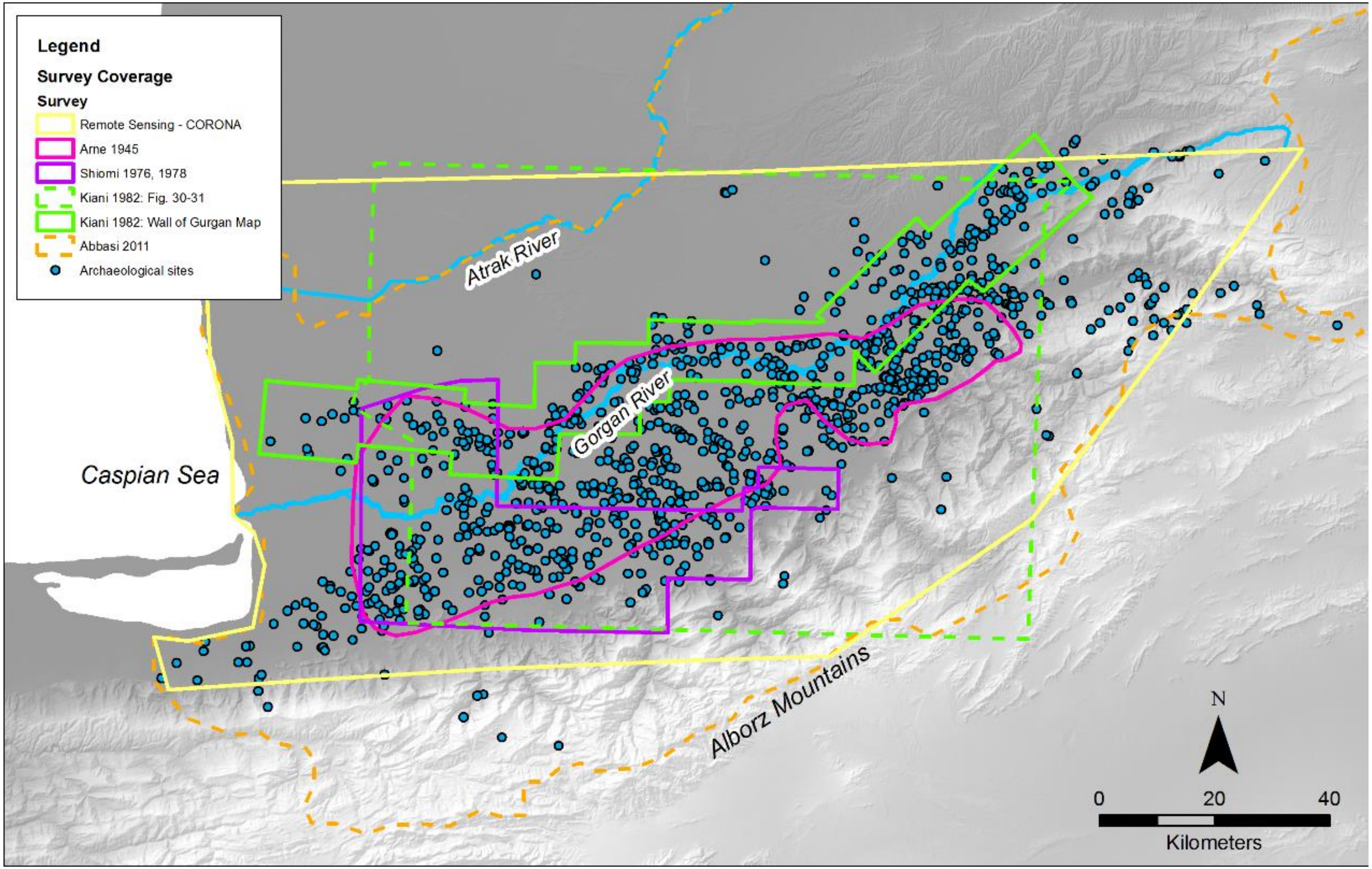


Figure 5-6: Morphology of archaeological sites and features from published field survey data and the remote sensing of CORONA and GAMBIT imagery. Note the concentration of low-level relief sites located on the higher resolution GAMBIT imagery near the Caspian coastline.

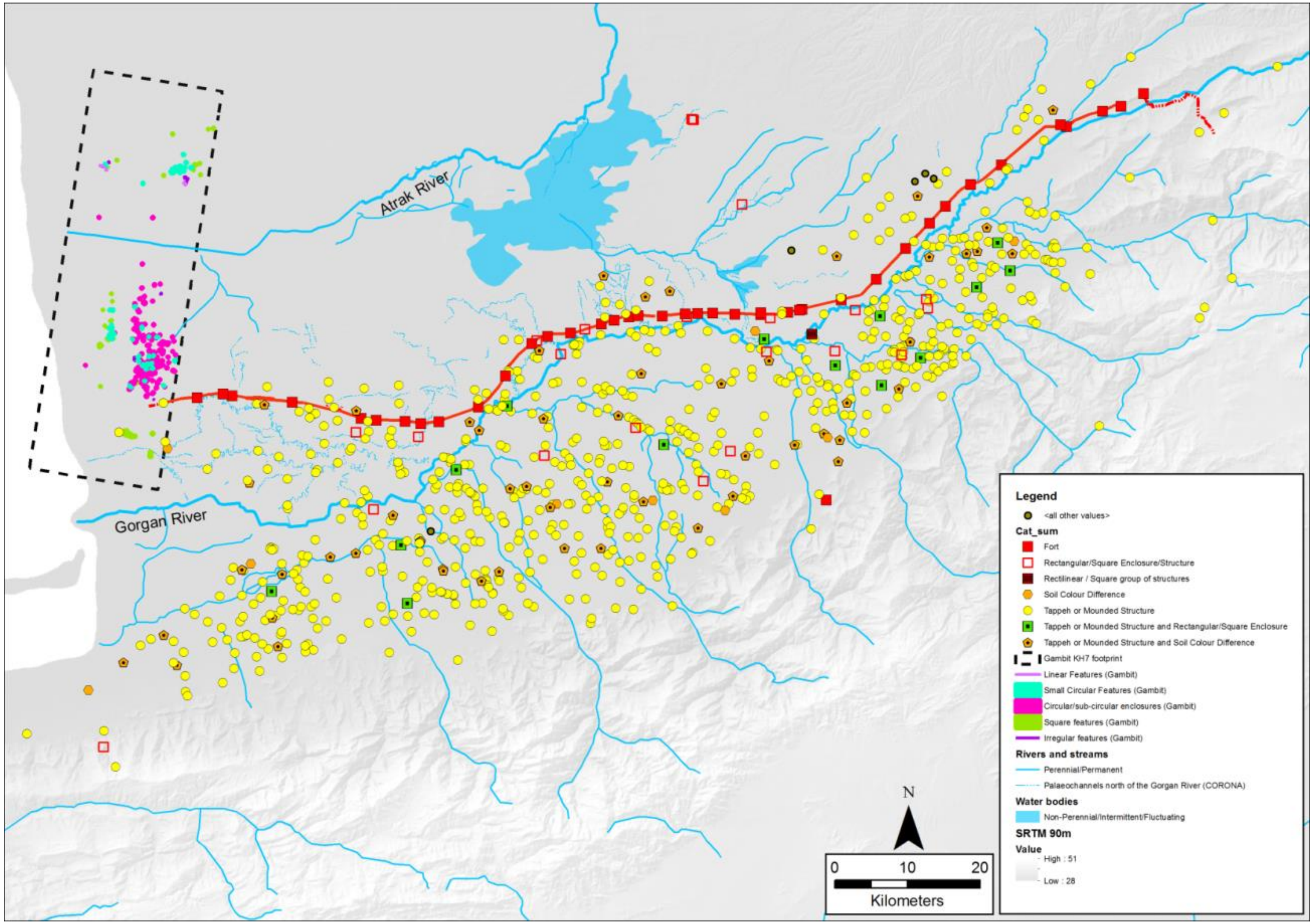


Figure 5-7: Sites visited by the *GWS* between 2005 and 2009. Basemap SRTM 90m DEM (Imagery available from the US Geological Survey).

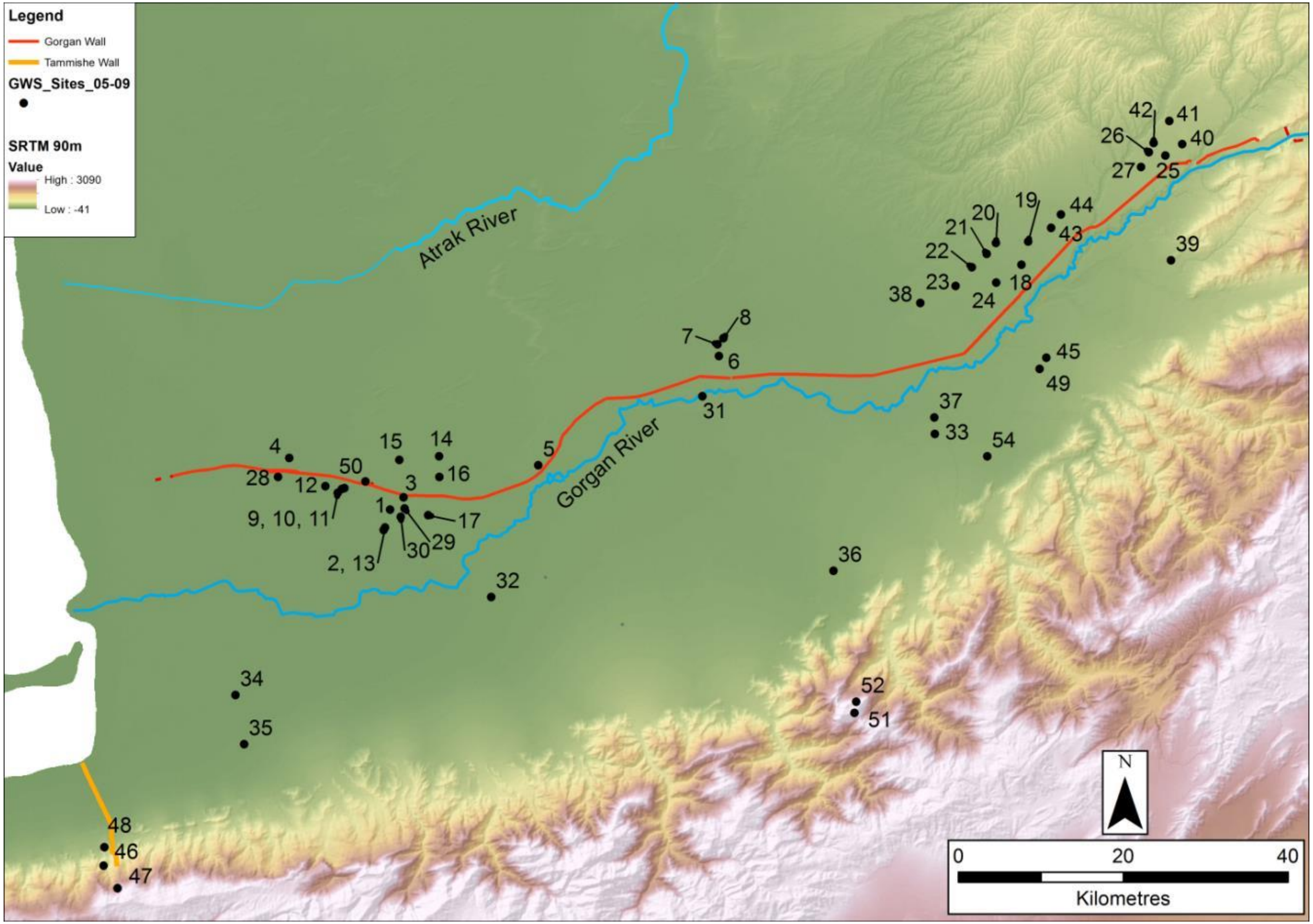


Figure 5-8: *GWS* sites dated to the Prehistoric periods. Basemap SRTM 90m DEM (Imagery available from the US Geological Survey).

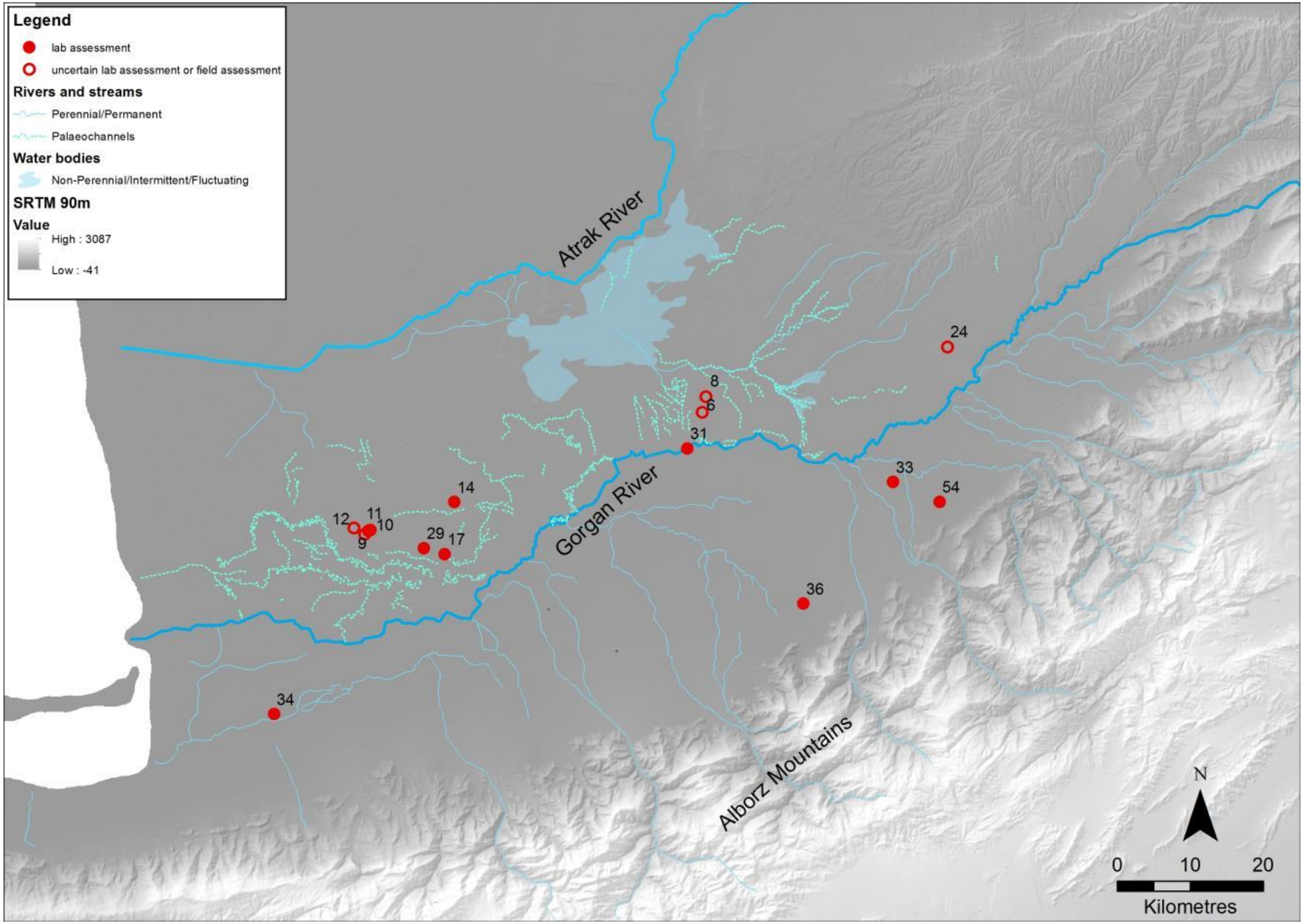


Figure 5-9: *GWS* sites dated to the Iron III period, or sites with material related to, but potentially earlier than the Iron III period. Basemap SRTM 90m DEM (Imagery available from the US Geological Survey).

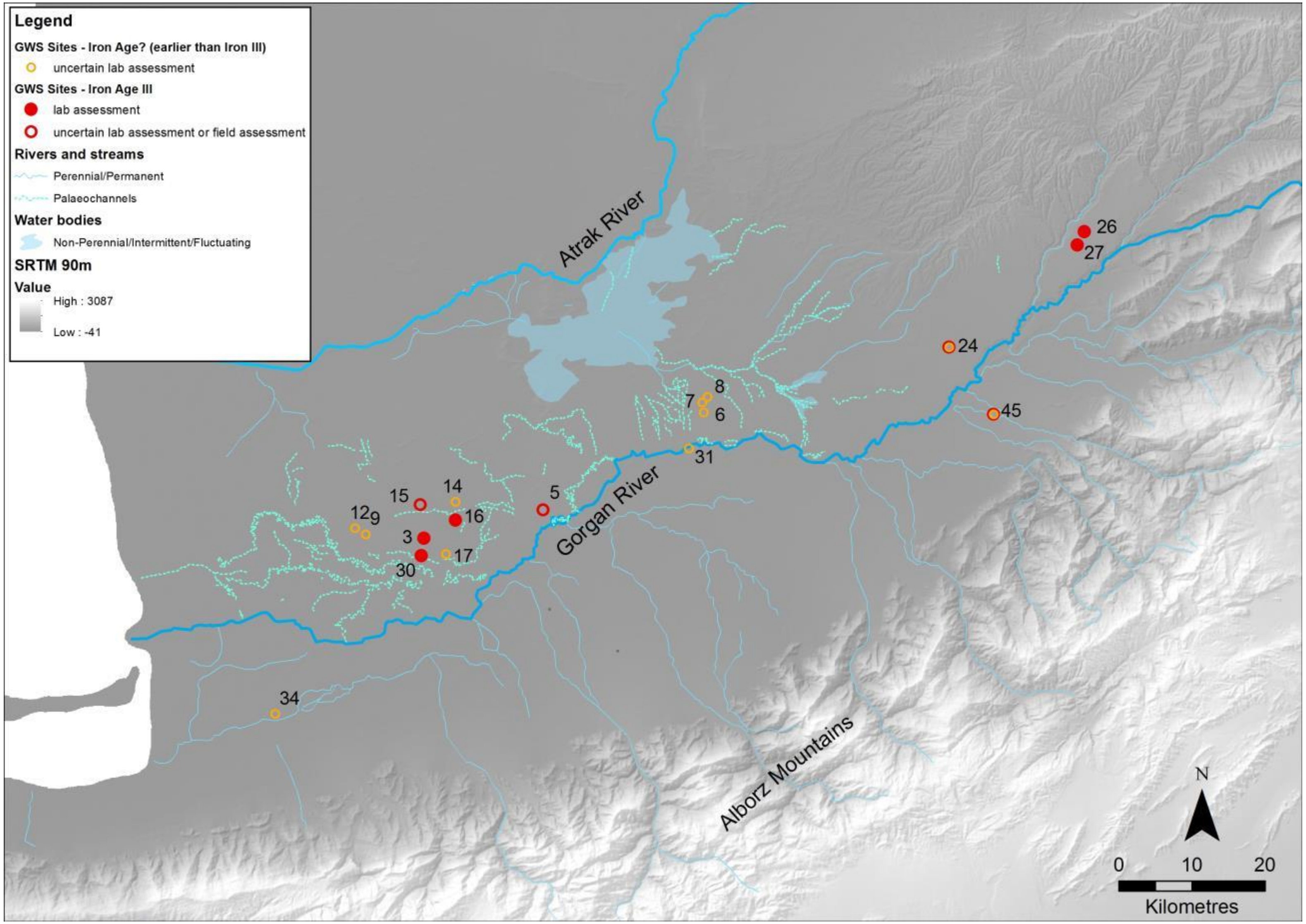


Figure 5-10: *GWS* sites dated to the Iron IV, Achaemenid or Parthian period. Basemap SRTM 90m DEM (Imagery available from the US Geological Survey).

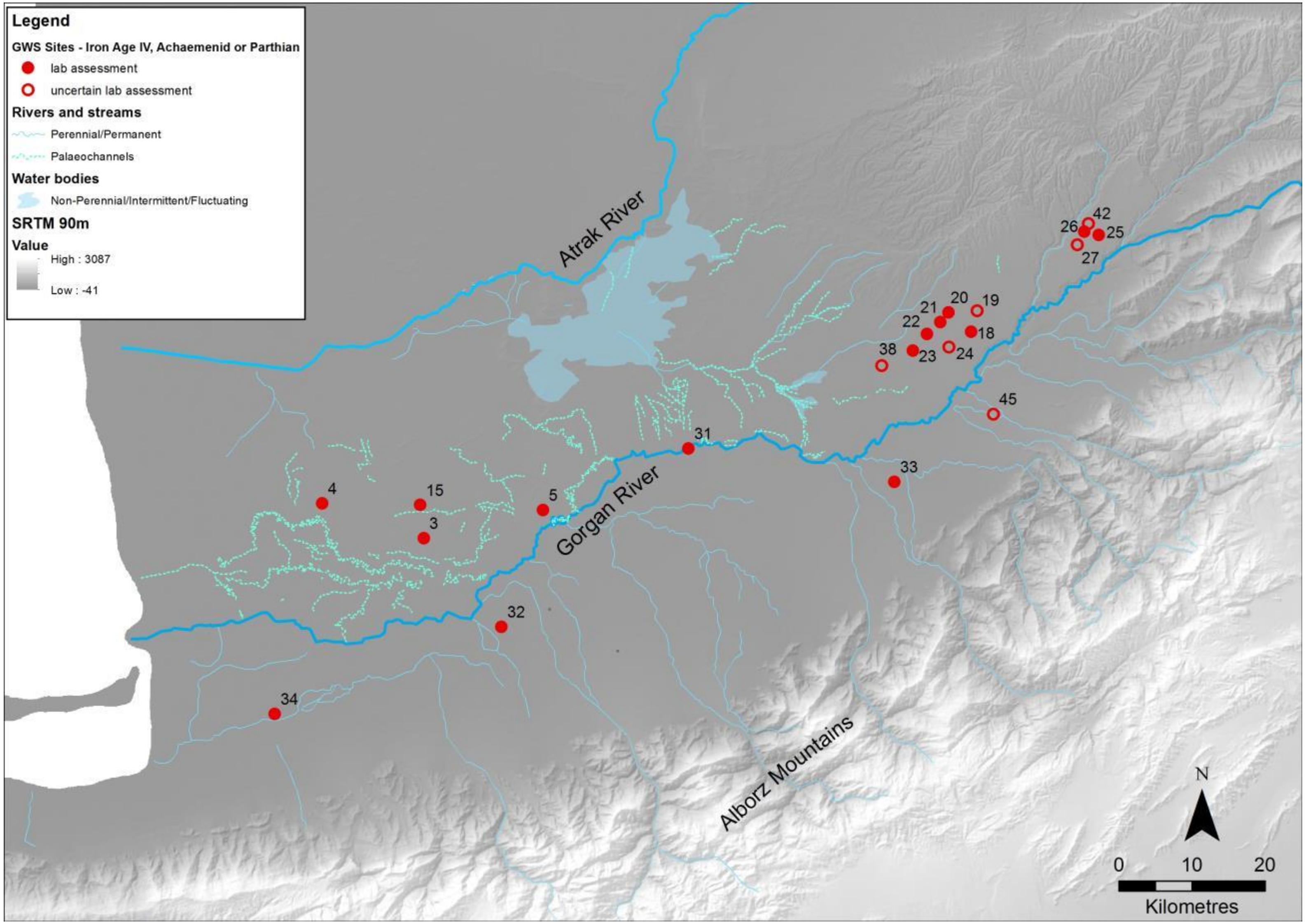


Figure 5-11: GWS sites dated to the Early Sasanian, Mid to Late Sasanian, or just broadly to the Sasanian period. Basemap SRTM 90m DEM (Imagery available from the US Geological Survey).

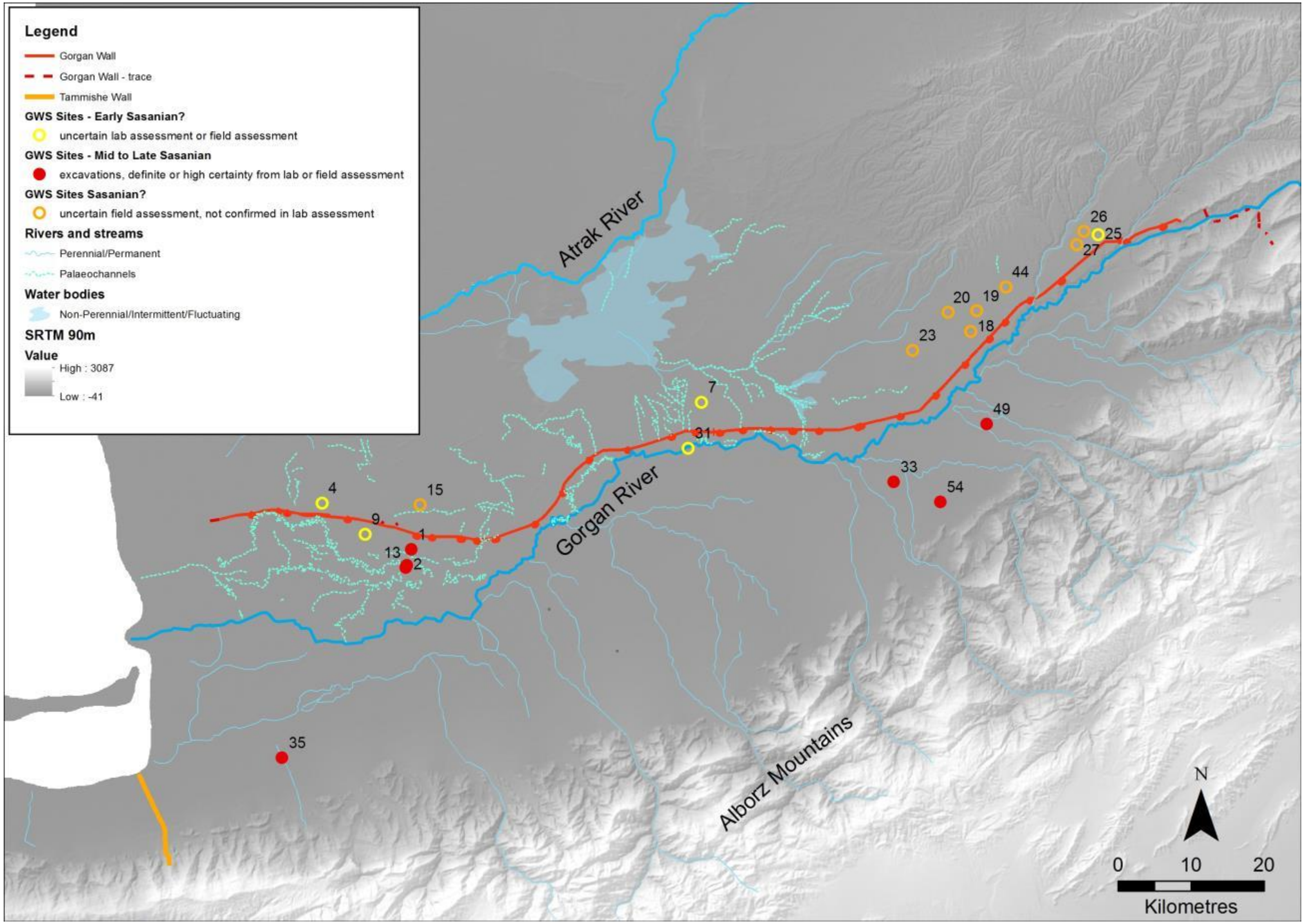


Figure 5-12: GWS sites dated to the Islamic period. Basemap SRTM 90m DEM (Imagery available from the US Geological Survey).

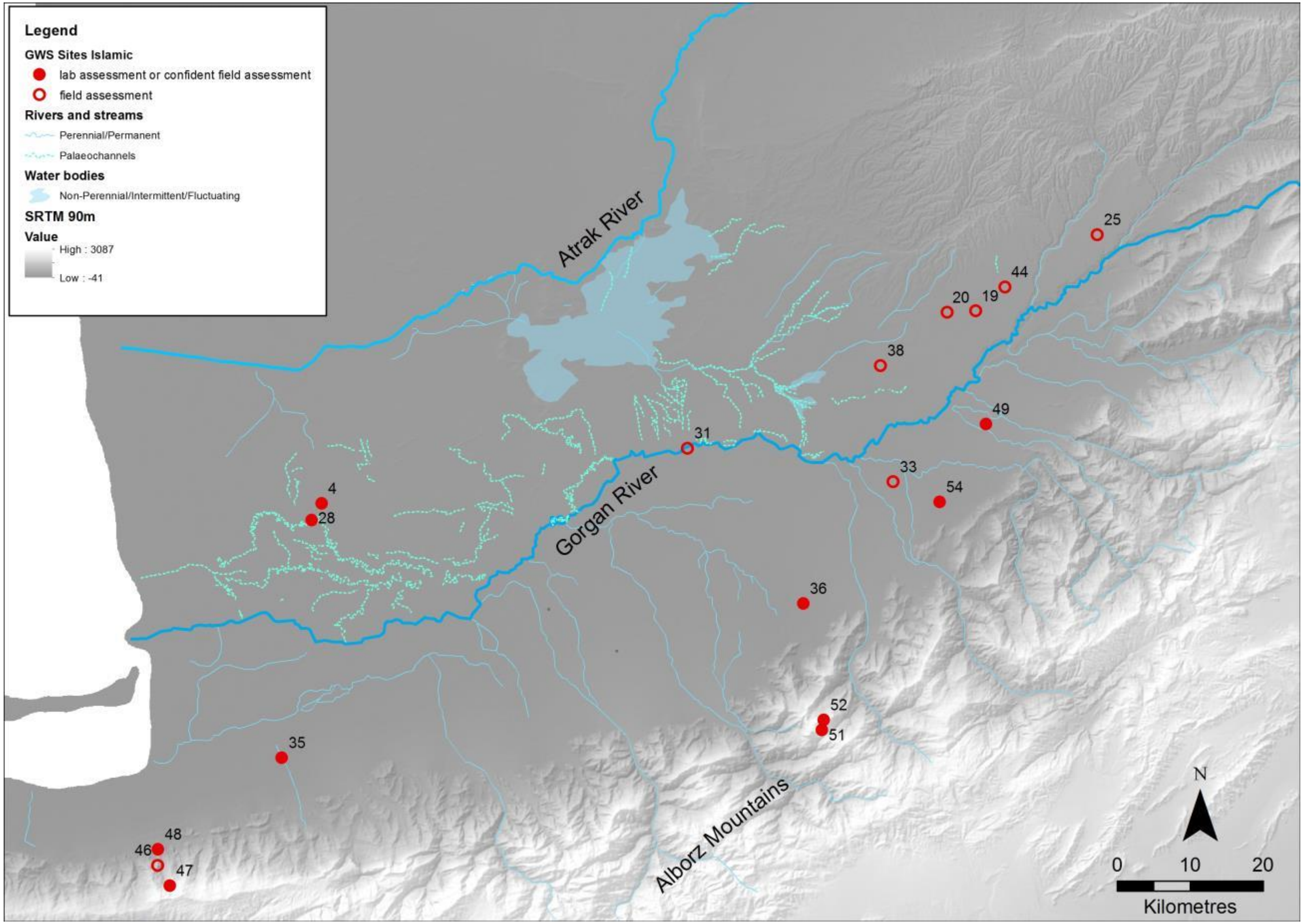


Figure 5-13: Site numbers by period in the Abbasi (2011: Map 5 -14) dataset

6. LANDSCAPES OF THE LATE IRON AGE THROUGH PARTHIAN PERIODS ON THE GORGAN PLAIN

Figure 6-1: Archaic Dehistan sites on the Misrian Plain. The canals potentially associated with the sites are also pictured. After Lecomte 2009, Fig. 6.

Image redacted due to copyright

Figure 6-2: Environmental sub-zones of the plain discussed in this chapter (Landsat imagery available from the US Geological Survey).

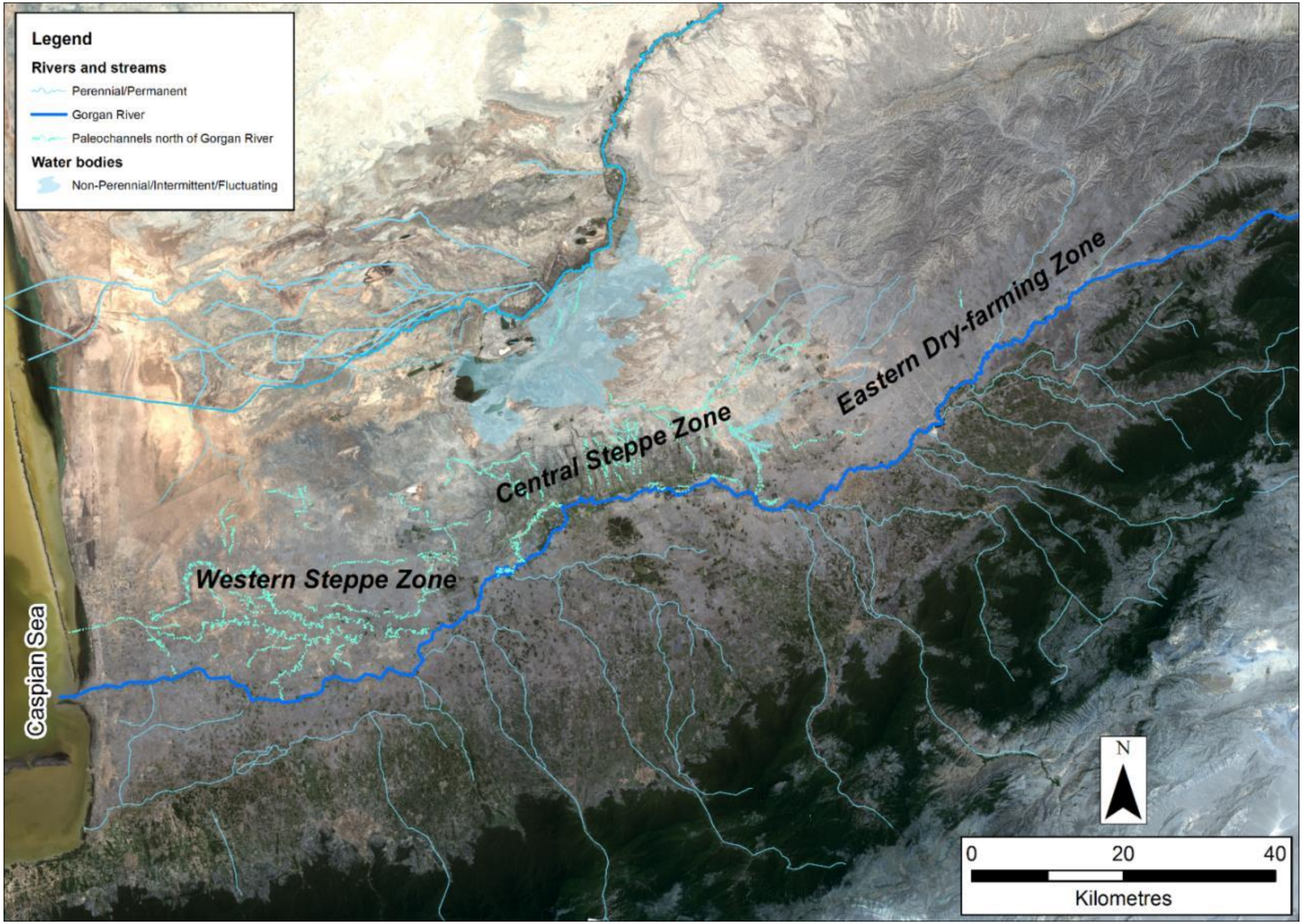


Table 6-1: Sites surveyed by the *GWS* to the north of the modern Gorgan River. Sites are listed by geographical subzone (see Fig. 6-2). Additional dating information from other surveys is also given. Coordinates in UTM 40N.

	DATABASE PARENT_ID	NAME	C-14 DATES (IN BOLD) OR LAB ASSESSMENTS OF CERAMICS	FIELD ASSESSMENTS (UNCERTAIN)	DATING FROM OTHER SURVEYS	EASTING	NORTHING
North of modern Gorgan River – Western Steppe Zone	GWS_1	Qal'eh Kharabeh	**Sasanian**	-	Red-brown polished pottery (Shiomi 1976); Parthian, Sasanian (Kiani 1982b)	271313	4109312
	GWS_2	Buraq Tappeh	Sasanian	-	Iron Age III/IV (Abbasi 2011)	270703	4107128
	GWS_3	Un-named	Iron Age III and IV	-		272960	4110812
	GWS_4	Tokhmaq Tappeh	Iron Age IV, Parthian? Early Sasanian? Islamic	Parthian, Sasanian, Early Islamic	Prehistoric, Parthian, Sasanian (Kiani 1982b)	259075	4115591
	GWS_5	Un-named	Iron Age III? Iron Age IV	Parthian	-	289305	4114691
	GWS_9	Gugjeh Kuchek	Iron Age? Early Sasanian?	Bronze Age?	-	264949	4111337
	GWS_10	Gugjeh Bozorg	Bronze Age	-	-	265480	4111830
	GWS_11	Quleh Saran	Chalcolithic/Bronze Age	-	Painted pottery and grey polished pottery (Shiomi 1976)	265779	4111915
	GWS_12	Un-named	Chalcolithic/Bronze Age, Iron Age?	-	-	263478	4112166
	GWS_13	Buraq Tappeh Jonubi	Sasanian	-	-	270521	4106811
	GWS_14	Qareh Qoli or Chuni 1	Bronze Age. Early Iron Age?	-	Grey polished pottery (Shiomi 1976)	277246	4115784
	GWS_15	Mangali	Iron III, Iron IV	Parthian, Early Sasanian		272449	4115364

	DATABASE PARENT_ID	NAME	C-14 DATES (IN BOLD) OR LAB ASSESSMENTS OF CERAMICS	FIELD ASSESSMENTS (UNCERTAIN)	DATING FROM OTHER SURVEYS	EASTING	NORTHING
North of modern Gorgan River – Western Steppe Zone	GWS_16	Qelich Qoineq or Chuni 2	**Iron III**	-	Grey and red brown polished pottery (Shiomi 1976)	277297	4113292
	GWS_17	Tappeh Karamin	Bronze Age. Early Iron Age?	-	Red-brown polished pottery (Shiomi 1976)	275923	4108634
	GWS_28	Altin Tappeh	-	Middle Islamic	Islamic (Kiani 1982b; Shiomi 1976)	257707	4113287
	GWS_29	Qareh Baba 1	Bronze Age	-	Painted pottery and grey polished pottery (Shiomi 1976)	273089	4109437
	GWS_30	Qareh Baba 2	Iron Age III	-	Red-brown polished pottery (Shiomi 1976)	272606	4108428
	GWS_50	Qizlar Qal'eh	No date		Prehistoric, Parthian and Sasanian (Kiani 1982b);Red brown polished pottery (Shiomi 1976)	268318	4112747
	TJW_5	Un-named	No date			276250	4109581
	TJW_6	Un-named	No date			286533	4108372
	TJW_8	Un-named	No date			267003	4107781
North of modern Gorgan River – Central Steppe Zone	GWS_6	Nurjan Tappeh	Bronze Age? Iron Age?	-	Prehistoric, Parthian, Sasanian (Kiani 1982b)	311227	4128007
	GWS_7	Toqelijiq	Iron Age? Early Sasanian?	-	-	311053	4129427
	GWS_8	Hevaz-Yalanchi	Bronze Age? Iron Age?	-	-	311747	4130172
	TJW_2	Un-named	No date			330051	4125581
	TJW_3	Un-named	No date			328449	4125086

	DATABASE PARENT_ID	NAME	C-14 DATES (IN BOLD) OR LAB ASSESSMENTS OF CERAMICS	FIELD ASSESSMENTS (UNCERTAIN)	DATING FROM OTHER SURVEYS	EASTING	NORTHING
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS_18	Dish Tappeh	Iron Age IV	Iron III?	EBA, Iron Age III/IV, Achaemenid and Parthian (Abbasi 2011)	347917	4139121
	GWS_19	Malek A'li Tappeh	-	Parthian, Sasanian, Middle Islamic	Iron Age III/IV, Achaemenid, Parthian, Sasanian, Islamic (Abbasi 2011)	348732	4141945
	GWS_20	Abadan Tappeh Bozorg	Iron Age IV	Parthian, Sasanian, Middle Islamic	Sasanian and Islamic (Abbasi 2011)	344829	4141746
	GWS_21	Abadan Tappeh Kuchek	Iron Age IV	Parthian	Prehistoric, Middle Islamic (Kiani 1982b); Parthian and Sasanian (Abbasi 2011)	343689	4140421
	GWS_22	Mo'la A'li Tappeh	Iron Age IV	-	Prehistoric, Islamic (Kiani 1982b); Iron Age III/IV, Achaemenid, Parthian, Sasanian, Islamic (Abbasi 2011)	341887	4138800
	GWS_23	Qareh Mohammed Tappeh	Iron Age IV	Parthian, Sasanian	Iron Age III/IV, Achaemenid, Parthian (Abbasi 2011)	339934	4136516
	GWS_24	Qelich Oliya	Bronze Age? Iron Age?		Iron Age III/IV, Achaemenid (Abbasi 2011)	344875	4136949
	GWS_25	Gangush Tappeh 1	Iron Age IV, Early Sasanian?	Parthian, Islamic	Iron Age III/IV (Abbasi 2011)	365385	4152386
	GWS_26	Gangush Tappeh 2	Iron Age III, Iron Age IV	Parthian, Sasanian	Iron Age III/IV, Achaemenid, Parthian (Abbasi 2011)	363400	4152817

	DATABASE PARENT_ID	NAME	C-14 DATES (IN BOLD) OR LAB ASSESSMENTS OF CERAMICS	FIELD ASSESSMENTS (UNCERTAIN)	DATING FROM OTHER SURVEYS	EASTING	NORTHING
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS_27	Gangush Tappeh 3	Iron Age III. Early Iron Age? Iron Age IV?	Parthian, Sasanian	Iron Age III/IV, Achaemenid, Parthian (Abbasi 2011)	362416	4151010
	GWS_38	Guzni Tappeh	-	Parthian (?), Islamic	Iron Age III/IV, Parthian, Islamic (Abbasi 2011); Prehistoric, Parthian and Islamic (Kiani 1982b)	335665	4134447
	GWS_40	Ishan Aqa	-	Gorgan Wall bricks found on surface	Early Bronze Age (Abbasi 2011)	367415	4153778
	GWS_41	Qal'eh Kuh Kaleh	No date		Iron Age III/IV (Abbasi 2011)	365856	4156609
	GWS_42	Gangush Tappeh 4	-	Iron Age IV?	Achaemenid and Parthian (Abbasi 2011)	363944	4153911
	GWS_43	Gugjeh Tappeh	No date		Iron Age III/IV, Achaemenid and Parthian (Abbasi 2011)	351524	4143583
	GWS_44	Qareh Qoli	-	Sasanian, Islamic	Parthian, Islamic (Abbasi 2011)	352713	4145215
	TJW_4	Un-named	No date			347041	4138825

Table 6-2: Sites dated to the Iron Age III, IV, Achaemenid and Parthian periods by the *GWS* north of the Gorgan River (from Table 6-1) and south of the Gorgan River. Data from Wilkinson et al. 2013: 102-129). Site counts by certainty of dating are provided at the bottom of the table.

	DATABASE PARENT_ID	IRON AGE III	IRON AGE IV	ACHAEMENID	PARTHIAN
North of modern Gorgan River – Western Steppe Zone	GWS_3				
	GWS_4				
	GWS_5				
	GWS_15				
	GWS_16				
	GWS_30				
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS_18				
	GWS_19				
	GWS_20				
	GWS_21				
	GWS_22				
	GWS_23				
	GWS_25				
	GWS_26				
	GWS_27				
	GWS_38				
	GWS_42				
South of modern Gorgan River	GWS_31				
	GWS_32				
	GWS_33				
	GWS_34				

	IRON AGE III		IRON AGE IV		ACHAEMENID		PARTHIAN	
Site Counts	Definite or High Certainty	Uncertain	Definite or High Certainty	Uncertain	Definite or High Certainty	Uncertain	Definite or High Certainty	Uncertain
	7	-	14	1	-	2	3	14

Excavated site
Lab assessment – confident of date
Uncertain assessment

Table 6-3: Ceramic assessments of *GWS* sites (listed in Table 6-2) occupied between the Iron Age III and the Parthian periods both north and south of the Gorgan River. Data from Wilkinson et al. 2013: 102-129; for form descriptions see Priestman 2013: 465-502.

	DATABASE PARENT ID	SITE	FABRICS	FORMS	DATE	NOTES
North of modern Gorgan River – Western Steppe Zone	GWS_3	GWS-3A	• Hard burnished grey wares • Hard burnished orange wares • Cooking pot	• 5 B4 • 1 CP5	Iron III	Precise parallels with Qelich Qoineq
		GWS-3B	• Hard burnished red wares	• J6 • Open forms (bowls)	Iron IV	J6 parallels QQ, but the rest appears later in date. The red burnished wares are all open forms.
	GWS_4	GWS-4	• Hard burnished red wares (often with reduced grey cores) • Some grey wares	• 1 B4 grey ware • 5 J9 • 6 beaded jar rims	Iron IV Parthian	Red wares predominate.
	GWS_5	GWS-5	• Hard red burnished wares • Grey wares • Coarse tempered cooking pot • Cream coloured wares	• 3 B4 • Carinated bowl with 'S profile' • 1 SP2 • 1 jar with narrow neck and pastille application on handle	Iron III Iron IV (including Achaemenid?) Parthian	Specific parallels to Qelich Qoineq, but most of the material appears slightly later.

	DATABASE PARENT ID	SITE	FABRICS	FORMS	DATE	NOTES
North of modern Gorgan River – Western Steppe Zone	**GWS_15**	GWS-15	• Hard red burnished wares (often with reduced grey cores) • Hard burnished grey and cream coloured wares • Red and grey ware bichrome)	• 3 B4 • 1 B7 • 1 beaded rim jar	Iron III Iron IV Parthian?	Parallels with Qelich Qoineq (B4, B7), but also material which indicate a later date.
	GWS_16	GWS_16	Type site for Iron III assemblage – see Chapter 4.1.3			
	GWS_30	GWS-30	• HARC.R • HARC.G • HARC.C • CORTEM	• 7 B4 • 1 B7 • 1 J5 • 1 SP2 • 2 CP5	Iron III	Clearly parallels Qelich Qoineq.
North of modern Gorgan River – Eastern Dry-Farming Zone	**GWS_18**	GWS-18	• Hard red and grey wares	• 2 B4 • 1 J9	Iron IV	B4 parallels Qelich Qoineq but the rest of the assemblages suggests slightly later dating.
	GWS_19	GWS-19	No lab assessment			
	GWS_20	GWS-20	• Hard burnished red ware (HARC.R) • Cream coloured ware (HARC.C)	• 4 J9 – both red and cream examples • 1 J10	Iron IV	Fabrics similar to Qelich Qoineq but forms indicate slightly later dating.

	DATABASE PARENT ID	SITE	FABRICS	FORMS	DATE	NOTES
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS_21	GWS-21	• Hard burnished red ware • Hard burnished grey ware • Red and grey ware bichrome) • Fine orange ware	• Carinated jar with 'S profile' and spout • 1 B4 • 1 B10 • Everted rims, carinated jar (in fine orange ware)	Iron IV (including Achaemenid?)	Red ware dominates, less quantities of grey ware. B4 parallels Qelich Qoineq but the rest suggests a slightly later date.
	GWS_22	GWS-22	• Hard red and grey wares • Red and grey ware (bichrome)	• 1 B4 • 1 J10	Iron IV	B4 parallels Qelich Qoineq, but the rest of the assemblages suggests slightly later dating.
	GWS_23	GWS-23	• Hard burnished grey ware • Hard burnished red ware • Cream coloured ware • Red and grey ware (bichrome)	• 1 B4 (tripod bowl) • Carinated jar with 'S profile' rim • 5 J10	Iron IV (Achaemenid?)	B4 parallels Qelich Qoineq, but the rest of the assemblages suggests slightly later dating.
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS_25	GWS-25A	• Hard burnished red ware • Hard burnished grey ware	• Vessels with rims with an 'S' profile, generally small in size • "bowl with thinning rim and projecting, horizontally aligned, rounded strap handle" (Wilkinson et al. 2013: 119) • 14 J10	Iron IV	Red ware dominates, less quantities of grey ware. Whole sample appears to be later than Qelich Qoineq.

	DATABASE PARENT ID	SITE	FABRICS	FORMS	DATE	NOTES
		GWS-25B	• Hard burnished red and grey wares • Coarse tempered cooking pot	• 1 J9 • 2 J10	Iron IV, Early Sasanian?	Whole sample postdates Qelich Qoineq. Might be slightly later in date than 25 A.
	GWS_26	GWS-26A	• Hard burnished red and grey wares • Cream coloured ware • Coarse tempered cooking pot (CORTEM)	• 1 B4 • 1 B7 • 2 Beaded rim bowls • 1 J9	Iron III Iron IV	B4, B7 and CORTEM indicated occupation contemporary to Qelich Qoineq, other elements suggest occupation into the Iron IV period.
		GWS-26B	• Hard burnished red and grey wares	• 1 B4 • J9 • J10 • Large storage jar	Iron IV	Red ware dominates, less quantities of grey ware. B4 parallels Qelich Qoineq, but the rest of the assemblages suggests slightly later dating.
North of modern Gorgan River – Eastern Dry-Farming Zone	**GWS_27**	GWS-27	• Hard burnished red and grey wares • Coarse tempered cooking pot	• 1 B4 • 1 J5 • LAGTEM? • 3 Beaded rim bowls	Earlier than Iron III? Iron III Iron IV?	B4, J5 and LAGTEM (?) suggest occupation contemporary to Qelich Qoineq. Beaded rim bowls may suggest occupation in a previous or subsequent period.
	GWS_38	GWS-38	No lab assessment			
	GWS_42	GWS-42	No lab assessment			

	DATABASE PARENT ID	SITE	FABRICS	FORMS	DATE	NOTES
South of the modern Gorgan River	**GWS_31**	GWS-31	• Bichrome ware		Iron IV? Parthian?	Preliminary assessment.
	GWS_32	GWS-32	• Bichrome ware • Fine black ware • Hard orange ware	• Plain hole mouth cooking pots • Cooking pots with combed decoration (orange ware)	Iron IV Parthian	Direct parallels with Tureng Tappeh VB-C were noted.
	GWS_33	GWS-33	• Bichrome ware • Red ware	• J10	Iron IV Parthian?	Also occupied in earlier and later periods.
	GWS_34	GWS-34	• Bichrome ware • Red ware	• J10 • Hole mouth cooking pots	Iron IV Parthian?	Also occupied in earlier periods.

Table 6-4: Morphology of sites (listed in Table 6-2) derived from field and imagery based data occupied in the Iron III, IV, Achaemenid or Parthian period in the *GWS* sample.

	DATABASE PARENT ID	GWS SITE	OVERALL SITE SIZE	SIZE OF QAL'EH / MAIN TAPPEH	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES
North of modern Gorgan River – Western Steppe Zone	GWS_3	GWS-3	c. 18 ha	c. 1.5 ha	Prominent (square?) qal'eh encircled by empty space/depression beyond which are low mounds to the north and west.	The south edge of the site is bordered by the South Canal. The Gorgan Wall runs immediately north of the site.
	GWS_4	GWS-4	c. 36 ha (enclosed with ramparts)	c. 1.5 ha	Prominent qal'eh in north central area of the site. Clear lower area surrounding the qal'eh, which is then surrounding by lower mounding. A higher rectilinear qal'eh is located in the northeast corner of site. Rectilinear ramparts appear to enclose the entire site. It is possible that these ramparts are later.	Less than half a kilometre north of the South Canal. A natural channel (Wilkinson et al. 2013: 113) flows past the east side of the site. Possible canal like features leading toward and out form the site.
	GWS_5	GWS-5	c. 27 ha	c. 1.5 ha	Prominent mound (with possible slightly concave interior) surrounding by lower mounding to the north, west and east. The extent of the site is very clearly delineated and there may be evidence for ramparts on the CORONA image on the W edge.	Canal branching off the North Canal may lead to the site (Wilkinson et al. 2013: 113).

	DATABASE PARENT ID	GWS SITE	OVERALL SITE SIZE	SIZE OF QAL'EH / MAIN TAPPEH	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES
North of modern Gorgan River – Western Steppe Zone	**GWS_15**	GWS-15	c. 14 ha visible in the field, but the site could be up to 85 ha (on CORONA)	c. 1 ha	Prominent square qal'eh surrounded by low outer mounds. An enclosed depression was noted to the west of the qal'eh (Wilkinson et al. 2013: 116). The extent of the site is difficult to determine on the CORONA.	Immediately to the north of the site are a mass of archaic field systems likely fed by the North Canal which runs c. 1 km north from the qal'eh. Numerous hollow ways radiate out from the site to the southwest, south and southeast. A canal/channel like feature may run roughly west-east to the south of the site.
	GWS_16	GWS-16	c. 80 ha, and up to c. 87 ha	c. < 0.5 ha	Prominent square qal'eh surrounded by a flat area/depression, which is in turn surrounded by low outer mounds. An outer wall encloses the entire site.	Archaic field systems located to the east, south and west. Possible hollow ways or channels located to north and south. Palaeochannel located running east-west to north of site.
	GWS_30	GWS-30	c. 8-9 ha	c. < 0.5 ha	Prominent qal'eh surrounded by a flat area/depression to the northeast , east , and southeast outside of which are low mounds.	c. 2 km south of the South Canal.

	DATABASE PARENT ID	GWS SITE	OVERALL SITE SIZE	SIZE OF QAL'EH / MAIN TAPPEH	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS_18	GWS-18	c. 15 ha	c. < 0.5 ha	Prominent qal'eh with surrounding mounds.	Broad radial hollow ways extending from site.
	GWS_19	GWS-19	At least c. 57 ha recorded in field, but mounding could extend further out under the village	c. < 0.5 ha recorded in field	Prominent qal'eh with surrounding mounds	Clear radial hollow ways extending out from site. Traces of possible relict field systems.

	DATABASE PARENT ID	GWS SITE	OVERALL SITE SIZE	SIZE OF QAL’EH / MAIN TAPPEH	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES
North of modern Gorgan River – Eastern Dry-Farming Zone	**GWS_20**	GWS-20	C. 12 ha recorded in the field for main site (up to c. 45 ha if later Islamic town is included)	c. 0.5 ha	The central qal’eh appears to be surrounded by an area of empty space (noted to the southwest of the qal’eh as a depression in the field), which is then enclosed by roughly rectilinear rampart. Mounding on the top/or equal to the height of the rampart in the visible on the imagery, appeared to represent build-up of cultural material (Wilkinson et al. 2013: 117), perhaps of a later date than the original ramparts?	Beyond the ramparts are the remains of an Islamic town as well as an extensive modern village. Radial hollow ways extend out from the site. Different phases of hollow ways are visible.
	GWS_21	GWS-21	c. 72 ha	Upper qal’eh is less than 0.5 ha, but lower qal’eh is c. 6.5 h	Upper qal’eh, with lower qal’eh surrounding it. Beyond this on all sides are a series of low mounds. Ramparts are clearly visible on the CORONA imagery to the east and South.	Radial hollow ways extend out from the site. Traces of relict field systems in the vicinity.
	GWS_22	GWS-22	c. 10 ha	c. 0.5 ha	Prominent tappeh with lower mounding to the north, west and south on imagery. In the field mounding was observed to south and southwest (Wilkinson et al. 2013: 118)	Radial hollow ways extend out from the site.

	DATABASE PARENT ID	GWS SITE	OVERALL SITE SIZE	SIZE OF QAL'EH / MAIN TAPPEH	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS_23	GWS-23	c. 7 ha recorded in the field, but the imagery suggests it might be slightly larger (c. 9 ha)	c. < 0.5 ha	Central qa'eh surrounded by a depression on the west and south sides c. 20 wide. Mounds visible to the north and east surrounding qal'eh. Wilkinson et al. (2013: 118) speculated that the mounding to the north may be part of a lower qal'eh. Village covers southern part of site.	Radial hollow ways extend from site.
	GWS_25	GWS-25	c. 27 ha	c. 0.5 ha	Prominent qal'eh with outer mounds enclosed within irregular ramparts. The ramparts on the southwest and southeast sides are very straight. A 'moat-like depression' was observed surrounding the qal'eh in the field (Wilkinson et al.2013: 119).	Radial hollow ways extend out from the site.
	GWS_26	GWS-26	c. 28 ha	c. 1.5 ha	Upper and lower qal'eh surrounded by outer mounds. A rectilinear enclosure is visible to the south.	Hollow ways radiate out from the site, and from near the rectilinear enclosure. Traces of old field systems are visible in the vicinity.
	GWS_27	GWS-27	c. 12 ha	c. < 0.5 ha	Circular tappeh surrounded by very low outer mounds. Boundaries of site are very diffuse.	Hollow ways radiate out from the site. Traces of old field systems are visible in the vicinity.

	DATABASE PARENT ID	GWS SITE	OVERALL SITE SIZE	SIZE OF QAL'EH / MAIN TAPPEH	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES
North of modern Gorgan River – Eastern Dry-Farming Zone	**GWS_38**	GWS-38	c. 8.5 ha recorded in field, but CORONA imagery suggests up to c. 19 ha	c. 0.5 ha	Prominent qal'eh surrounded by flat empty area (slight depression?) measuring between 30 and 70 m wide and low outer mounds. A clear bank is observed surrounding the outer mounds on the north and east that was also visible in the field (Wilkinson et al. 2013: 122). This could be the remains of a rampart surrounding the site.	Several hollow ways radiate out from the site.
	GWS_42	GWS-42	c.< 0.2 ha or less	c.< 0.2 ha or less	Small tappeh.	Hollow ways radiate out from the mound.
South of the modern Gorgan River	**GWS_31**	GWS-31	Unknown. Kiani (1982b: 60) suggests the site once covered an area of at least 200 ha.	c. 2-3 ha	A prominent mound with flat top, immediately south of the Gorgan River in the central plain. . An extensive lower town likely existed at some point as evidenced by anomalies on the imagery.	A massive area of (relict?) field systems (c. 2.5 km north-south and 5 km east - west) exists to the south of the site. Clearly disused on the modern imagery available on Google Earth.

	DATABASE PARENT ID	GWS SITE	OVERALL SITE SIZE	SIZE OF QAL'EH / MAIN TAPPEH	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES
South of the modern Gorgan River	**GWS_32**	GWS-32	At least c. 25 ha, but possibly much larger	c. 3-5 ha.	Large tappeh (qal'eh?) with dish shaped interior in the western plain, south of the Gorgan River. The area immediately around the mound appears to be flat, however, between 120-160 m both east and west, possible outer mounds can be seen on the CORONA image. Within the mounding to the west is a clear prominent tappeh, and other low mounds.	
	GWS_33	GWS-33	c. 50 ha (including the rectilinear enclosure.	c. 2.5 ha	A prehistoric mound (qal'eh with dish shaped interior), also occupied in the Iron IV or Parthian period incorporated into a large rectilinear enclosure, likely Sasanian (see chapter 7). The mound forms the southern corner of the large enclosure. In the eastern plain, south of the Gorgan River.	Possible mounding extending to the south of the prominent qal'eh for at least 500 m?
	GWS_34	GWS-34	c. < 0.8 ha		A steep-side prominent mound. No evidence for mounding beyond the tappeh on the CORONA, however, relict fields are visible to the northwest. In the western plain, south of the Gorgan River	A palaeochannel of the Kara Su River runs c. 400 m to the north of the site.

Table 6-5: GWS sites with morphological similarities to known Late Iron Age through Parthian period sites. These sites were either not dated, spot dated to a post-Parthian horizon (and not subsequently assessed in the lab), or identified only on the imagery.

	DATABASE PARENT ID	GWS SITE	OVERALL SITE SIZE	SIZE OF QAL'EH / MAIN TAPPEH	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	GWS DATING	OTHER DATING
North of modern Gorgan River – Western Steppe Zone	GWS_50	GWS-50	c. 73 ha recorded in the field. On the imagery it may extend farther, encompassing an area of c. 136 ha.	c. 2 ha	A prominent central qal'eh surrounded by a flat area, surrounded by lower outer mounds. The full extent of the site is difficult to determine. It appears to have been cut by and then incorporated into the Gorgan Wall (Wilkinson et al. 2013: 124).	A hollow way, cut by the Gorgan Wall, is seen to lead away from the site toward the southeast. The South Canal runs to the north of the site, and another canal feature may lead to the site. Archaic field systems are visible in the vicinity.	No date available.	Prehistoric, Parthian, Sasanian (Kiani 1982b)
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS_43	GWS-43	<0.1 ha (located in field) but mounding and other anomalies on the imagery could indicate up to c. 12 ha of site area.	c. <0.1 ha	Imagery suggests a grouping of low mounds, but only a small prominent tappeh was located in field (Wilkinson et al. 2013: 123).	Hollow ways lead toward, but do not appear to radiate out from the site.	No date available.	Iron Age III/IV, Achaemenid and Parthian (Abbasi 2011)

	DATABASE PARENT ID	GWS SITE	OVERALL SITE SIZE	SIZE OF QAL'EH / MAIN TAPPEH	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	GWS DATING	OTHER DATING
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS_44	GWS-44	The entire site (based on the outer mounding on the CORONA) may be up to 30 ha in size.	The main mound is c. 1.3 ha	Main mound with slightly dish-shaped interior and surrounding flat area; another smaller mound was located immediately to the south in the field (Wilkinson et al. 2013: 123). On the imagery it appears than further mounding may have existed around the main mound, and a large depression is located immediately to the south. The traces of a bank or wall are visible on the CORONA imagery around the entire site.	Hollow ways radiate out from the site.	Field assessment suggested Sasanian and Islamic. No lab assessment was undertaken.	Parthian and Islamic (Abbasi 2011)
South of the modern Gorgan River	GWS_55	GWS-55	The entire site including ramparts is c. 62 ha. All size estimates from CORONA imagery	Central qal'eh < 1ha, while the corner citadel is c. 3 ha	The outer ramparts of the site form a parallelogram. There is a central qal'eh surrounded by areas of mottling that may represent low outer mounds. A square citadel is visible in the southeast corner of the rampart.	A possible canal feature runs toward the northwest corner of the site and appears to have supplied water to the ditch surrounding the ramparts. Another possible canal feature may join the ditch on the southern side of the site to the west of the corner citadel.	Not visited in field	None

Table 6-6: Sites surveyed by the *GWS* with ceramics related to Qelich Qoineq (Iron III), but likely representing an earlier chronological horizon.

	DATABASE PARENT ID	SIZE	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	DATING - LAB ASSESSMENT (UNLESS OTHERWISE STATED)	OTHER DATING EVIDENCE
North of modern Gorgan River – Western Steppe Zone	GWS-9	c. 0.5 to 1.5 ha	Low mound observed in field, visible but very faint on the imagery.	Within area of archaic field systems.	Iron Age? Early Sasanian? Some material appears to predate Qelich Qoineq assemblage.	None
	GWS-12	c. 0.5 ha (appears as a larger complex topographic mound on imagery – c. 3 ha)	Small, low round tappeh.	Two canal-like features converge on toward the site, but Wilkinson et al. (2013: 115) observed that the canals finished before reaching the top of mound. A possible canal feature runs past the northeast of the site.	Chalcolithic/Bronze Age, and fine red and grey wares similar, but not identical to Qelich Qoineq.	None
	GWS-14	c. 11 ha recorded in the field. Perhaps slightly larger on CORONA – c. 14 ha. Shiomi (1976) map indicates an area of at least 22 ha.	Low group of mounds; the site is cut by a modern road.	Traces of possible palaeochannel and canal features located immediately south and west of the site. Relict field systems visible to southwest of site within 500 m. Less distinct traces of field systems to the east.	Bronze Age? Appears to predate Qelich Qoineq assemblage.	Grey polished pottery (Shiomi 1976-78)

	DATABASE PARENT ID	SIZE	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	DATING - LAB ASSESSMENT (UNLESS OTHERWISE STATED)	OTHER DATING EVIDENCE
North of modern Gorgan River – Central Steppe Zone	GWS-6	c. 1 ha mound. Outer site visible on CORONA may be up to 64 ha.	Faint low mound surrounded by mounding, possibly contained within ramparts, such as suggested by Kiani (1982b: 43). In the field only the central low mound is visible (Wilkinson et al. 2013: 114).	-	Similar to material from Qelich Qoineq but no exact parallels. Maybe earlier? Bronze or Iron Age.	Prehistoric, Parthian and Sasanian (Kiani 1982b)
North of modern Gorgan River – Central Steppe Zone	GWS-7	c. 1.5 ha	Low teardrop shaped mound. A large depression is visible on the imagery to the east and south of the mound. No note of this feature was made in the field.	-	Iron Age or Early Sasanian. There were similarities with SMOG ware (from Fort 4), and cooking pots with similarities to MIGTEM at Qal'eh Kharabeh, however, they may also represent a slightly earlier horizon.	None
	GWS-8	c. 1.5 ha tappeh. On the CORONA imagery there are possible outer mounds that extend over an area of up to 30 ha.	Small tappeh, with possible outer mounding to the south and west of the mound. A depression is visible to the S. The site was very disturbed in the field visit (Wilkinson et al. 2013: 114)	-	Bronze Age? Iron Age? Appears to predate Qelich Qoineq assemblage.	None

	DATABASE PARENT ID	SIZE	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	DATING - LAB ASSESSMENT (UNLESS OTHERWISE STATED)	OTHER DATING EVIDENCE
North of modern Gorgan River – Eastern Dry-Farming Zone	GWS-24	c. <0.5 ha mound observed in the field; if the outer mounding visible on the CORONA is taken into account then the site may be c. 7-8 ha	Prominent tappeh with some outer mounding to the north observed in the field (Wilkinson et al. 2013: 119). On the CORONA imagery faint traces of outer mounding exist in all directions.	Hollow ways radiate out from the site to the northwest, northeast and east.	Bronze or Iron Age? Some similarities to the Qelich Qoineq assemblage, but no direct parallels.	Iron Age III/IV and Achaemenid in the Abbasi (2011) dataset.
South of the modern Gorgan River	GWS-45	c. < 0.5 ha	Small circular tappeh.	-	No lab assessment. Field assessment indicated Iron Age.	Iron Age III/IV in the Abbasi (2011) dataset.

Table 6-7: Other sites in the western steppe sub-zone (with dating information if available) to the north of modern Gorgan River that are not discussed in tables 6-9 and 6-10. Coordinates are given in UTM Zone 40N.

PARENT_ID	SIZE	MORPHOLOGY (FROM IMAGERY AND FIELD DERIVED DATA WHERE AVAILABLE – DISCEPANCIES NOTED)	DATING	EASTING	NORTHING	SITE CERTAINTY (ARCHAEOLOGICAL SIGNFICANCE)
ARNE_127	c. 4 ha (CORONA) 206 m x 240 m, H = 6.1 m (Shiomi 1976)	Circular tappeh	Islamic (Shiomi 1976)	265084	4106335	Definite
ARNE_128	c. 4 ha (CORONA) 180 x 150 m, H = 4 m (Shiomi 1976) 200 m x 134 m, H = 4.3 m (Arne 1945)	Two ovoid mounds	Red brown pottery (Shiomi 1976)	261870	4102922	Definite
ARNE_129	No dimensions recorded (Arne 1945)	Not able to clearly associate with a site on the CORONA image.		265972	4104162	Medium
ARNE_13	1.8 ha (CORONA) 100 m x 150 m, H = 5m (Arne 1945)	Ovoid tappeh		291803	4113791	Definite
ARNE_133	c. 10.6 ha 150 m x 125 m, H = 10-15 m (Arne 1945) 136 m x 168 m, H = 13.5 m (Shiomi 1976)	Recorded as a rectilinear tappeh in field survey (Arne 1945 and Shiomi 1976), but the site appears to consist of a larger topographic mound (with an upper rectilinear tappeh) on the CORONA.	Islamic (Arne 1945, Shiomi 1976)	277338	4104437	Definite
ARNE_135	320 m x 275 m, H = 5-10 m (Arne 1945)	Irregular tappeh	Islamic (Arne 1945)	272971	4100532	Definite
ARNE_137	H = < 5 m (Arne 1945)	Tappeh (Arne 1945); cannot be confidently associated with a site on the CORONA image		293568	4117761	Medium

PARENT_ID	SIZE	MORPHOLOGY (FROM IMAGERY AND FIELD DERIVED DATA WHERE AVAILABLE – DISCEPANCIES NOTED)	DATING	EASTING	NORTHING	SITE CERTAINTY (ARCHAEOLOGICAL SIGNFICANCE)
ARNE_138	c. 8 ha (CORONA) 240 m x 80 m, H = 10-15 m (Arne 1945) 340 m, c. 280 m, c. 6.7 ha (Kiani 1982b)	Irregular tappeh	MBA (Abbasi 2011)	292312	4117846	Definite
ARNE_14	H = 3.5 m (Arne 1945)	Circular tappeh; not visible on CORONA image		291883	4114625	Definite
ARNE_15	Overall site possibly c. 27 ha (CORONA) 150 m x 200 m , H = 3.5 m (Arne 1945) 480 m x 270 m (Kiani 1982b)	Ovoid tappeh recorded in field (Arne 1945), but a surrounding soil colour difference possibly representing a lower site appears on the CORONA and is noted in the Kiani (1982b) map as dark mottling.		287014	4110762	Definite
ARNE_160	5 m diameter, H = 1.5 m (Arne 1945)	Burial mounds (x 2); text reference only; not visible on the CORONA image		289620 (centroid of 500 m buffer)	4112517 (centroid of 500 m buffer)	Definite
ARNE_181		Tappeh (unknown); cannot be confidently associated with a site on the CORONA image (Arne 1945)		278010	4103765	Medium
ARNE_182		Tappeh (unknown); cannot be confidently associated with a site on the CORONA image (Arne 1945)		277507	4103580	Medium
ARNE_183		Tappeh (unknown); cannot be confidently associated with a site on the CORONA image (Arne 1945)		267612	4113872	Medium
ARNE_248	15-30 m and 12 m in diameter (Arne 1945)	Burial mounds (x 2); text reference only; not visible on the CORONA image		268792 (centroid of 500 m buffer)	4110951 (centroid of 500 m buffer)	Definite
ARNE_249	5 and 4 m in diameter (Arne 1945)	Burials mounds (x 2); cannot be confidently associated with a site on the CORONA image; in the vicinity of ARNE_138, but text reference only		292403 (centroid of 500 m buffer)	4117603 (centroid of 500 m buffer)	Definite

PARENT_ID	SIZE	MORPHOLOGY (FROM IMAGERY AND FIELD DERIVED DATA WHERE AVAILABLE – DISCEPANCIES NOTED)	DATING	EASTING	NORTHING	SITE CERTAINTY (ARCHAEOLOGICAL SIGNFICANCE)
ARNE_253	70 m diameter, H = 4m (Arne 1945)	Circular tappeh; cannot be confidently associated with a site on the CORONA image, may be part of the ARNE_75 site complex, but text reference only		277111 (centroid of 500 m buffer)	4105195 (centroid of 500 m buffer)	Definite
ARNE_254		Tappeh (unknown); cannot be confidently associated with a site on the CORONA image (Arne 1945)		266906	4110203	Medium
ARNE_8	c. 25 ha (CORONA) 1000 m x 100 m, H = 9 m (Arne 1945) 94 m x 83 m, H = 9.6 m (Shiomi 1976)	Appears as an irregular tappeh or mounded feature on the CORONA, but Shiomi (1976) indicates an ovoid morphology	Painted pottery and grey polished pottery (Shiomi 1976)	272495	4101305	Definite
ARNE_9	c. 5 ha (CORONA) 660 m diameter, H = 6 m (Arne 1945)	Irregular tappeh		272040	4099699	Definite
KH_106	< 1 ha (CORONA) H = 4m (Arne 1945) < 1 ha (Kiani 1982b)	Circular tappeh	Painted pottery, Prehistoric (Arne 1945)	293928	4116631	Definite
KH_107	c. 1.6 ha (CORONA) c. 5 ha (Kiani 1982b)	Ovoid tappeh on the CORONA, Kiani (1982b) indicates a map feature only.		287695	4115174	Definite
KH_11	c. 1 ha (CORONA and Kiani 1982b)	Rectilinear/square single structure/ enclosure		296251	4121983	Definite
KH_116	c. up to 5 ha? (CORONA) c. 1.3 ha (Shiomi 1976)	Ovoid tappeh note in field (Shiomi 1976), but CORONA indicates a possible surrounding depression?	Painted and grey polished pottery (Shiomi 1976-78)	267526	4116278	Definite

PARENT_ID	SIZE	MORPHOLOGY (FROM IMAGERY AND FIELD DERIVED DATA WHERE AVAILABLE – DISCEPANCIES NOTED)	DATING	EASTING	NORTHING	SITE CERTAINTY (ARCHAEOLOGICAL SIGNFICANCE)
KH_12	c. 3 ha (CORONA) 275 m x 175 m, H = 5 – 10 m (Arne 1945) c. 5 ha (Kiani 1982b)	Rectilinear tappeh or mounded structure with upper qal'eh (citadel?) (CORONA and Arne 1945); map feature recorded by Kiani is likely slightly bigger than actual site.	Islamic (Abassi 2011; Arne 1945)	292132	4112949	Definite
KH_149	c. 7 ha (CORONA)	Irregular soil colour difference (CORONA)	Sasanian and Islamic (Abbasi 2011)	245377	4107074	Definite
KH_150	c. 1ha (CORONA)	Circular tappeh (CORONA)		245062	4108022	High
KH_199	c. 1.7 ha (CORONA)	Rectilinear (?) tappeh (CORONA)		255225	4104045	High
KH_2	c. 35 ha (CORONA) c. 50 ha (Kiani 1982b)	Gomish Tappeh. Tappeh, and associated features including rectilinear features and area of soil colour difference visible on the CORONA, and KH7 GAMBIT imagery.	Prehistoric (Arne 1945)	238682	4109301	Definite
KIA_1	c. 4.5 ha (CORONA) c. 7 ha (Kiani 1982b)	Map feature indicated by Kiani (1982b), possible mounded feature visible on the CORONA image.		244814	4113377	Medium
KIA_12	c. 13 ha (Kiani 1982b)	Complex of low mounds indicated on Kiani (1982b) map; not visible on CORONA imagery.		251569	4113391	Medium
KIA_14	c. < 1 ha (CORONA) c. 10 ha (Kiani 1982b)	Complex of low mounds indicated by Kiani 1982b, but only one small mound (tappeh) visible on the CORONA imagery.		288167	4113852	Definite
KIA_2	c. 1.2 ha (CORONA) c. 2 ha (Kiani 1982b; Shiomi 1976)	Map feature indicated by dark mottling (Kiani 1982b), ovoid or possibly squared tappeh indicated by the CORONA and Shiomi (1976)	Grey polished pottery (Shiomi 1976-78)	276324	4107726	Definite
KIA_3	c. 2 ha (Kiani 1982b)	Map feature indicated by dark mottling (Kiani 1982b), not visible on the CORONA imagery.		275140	4108385	Low
KIA_4	c. 19 ha (Kiani 1982b)	Map feature indicated by dark mottling (Kiani 1982b), not visible on the CORONA imagery.		274876	4108933	Low

PARENT_ID	SIZE	MORPHOLOGY (FROM IMAGERY AND FIELD DERIVED DATA WHERE AVAILABLE – DISCEPANCIES NOTED)	DATING	EASTING	NORTHING	SITE CERTAINTY (ARCHAEOLOGICAL SIGNFICANCE)
KIA_44	c. 21 ha (Kiani 1982b)	Map feature indicated by dark mottling (Kiani 1982b), not visible on the CORONA imagery.		262296	4116366	Low
KIA_46	c. 7 ha (CORONA) c. 12 ha (Kiani 1982b)	Map feature indicated by dark mottling (Kiani 1982b), soil colour difference indicated on the CORONA imagery.		271391	4112349	Low
KIA_5	c. 19 ha (Kiani 1982b)	Map feature indicated by dark mottling (Kiani 1982b), not visible on the CORONA imagery.		277473	4107334	Low
KIA_57	c. 2.7 ha (Kiani 1982b)	Rectangular map feature indicated by dark mottling (Kiani 1982b), not visible on the CORONA imagery.		289766	4114005	Low
KIA_6	< 1ha (Kiani 1982b)	Map feature indicated by dark mottling (Kiani 1982b), not visible on the CORONA imagery.		277935	4108948	Low
KIA_7	< 1ha (CORONA) c. 1.5 ha (Kiani 1982b)	Map feature/rectangular square enclosure (Kiani 1982b). Part of a rectilinear feature is also visible on the CORONA image		279951	4108718	Medium
NTS_135	Location only (Abbasi 2011)	Cannot be confidently associated with a site on the CORONA imagery, may be part of the mounding in the vicinity of Fort 25.	EBA, MBA, LBA, Iron Age III/IV (Abbasi 2011)	282475 (centroid of 500 m buffer)	4110624 (centroid of 500 m buffer)	Definite
NTS_136	Location only (Abbasi 2011)	Cannot be confidently associated with a site on the CORONA imagery, may be part of the mounding in the vicinity of Fort 25.	EBA, Achaemenid, Iron Age III/IV (Abbasi 2011)	282569 (centroid of 500 m buffer)	4110983 (centroid of 500 m buffer)	Definite
NTS_164	Location only (Abbasi 2011)	Cannot be confidently associated with a site on the CORONA imagery.	Iron Age III/IV, Parthian, Islamic (Abbasi 2011)	247563 (centroid of 500 m buffer)	4112754 (centroid of 500 m buffer)	Definite
NTS_205	Location only (Abbasi 2011)	Cannot be confidently associated with a site on the CORONA imagery.	Sasanian and Islamic (Abbasi 2011)	275086 (centroid of 500 m buffer)	4109869 (centroid of 500 m buffer)	Definite
NTS_248	Location only (Abbasi 2011)	Cannot be confidently associated with a site on the CORONA imagery.	EBA, Achaemenid (Abbasi 2011)	272116 (centroid of 500 m buffer)	4109169 (centroid of 500 m buffer)	Definite

PARENT_ID	SIZE	MORPHOLOGY (FROM IMAGERY AND FIELD DERIVED DATA WHERE AVAILABLE – DISCEPANCIES NOTED)	DATING	EASTING	NORTHING	SITE CERTAINTY (ARCHAEOLOGICAL SIGNFICANCE)
NTS_351	Location only (Abbasi 2011)	Cannot be confidently associated with a site on the CORONA imagery.	Chalcolithic, EBA, MBA, Parthian, Islamic (Abbasi 2011)	287087 (centroid of 500 m buffer)	4112417 (centroid of 500 m buffer)	Definite
NTS_9	Location only (Abbasi 2011)	Cannot be confidently associated with a site on the CORONA imagery.	Neolithic	284859 (centroid of 500 m buffer)	4138319 (centroid of 500 m buffer)	Definite

Figure 6-3: Qelich Qoineq and environs on the CORONA imagery. Different phases of field systems are clearly visible (Imagery available from the US Geological Survey).

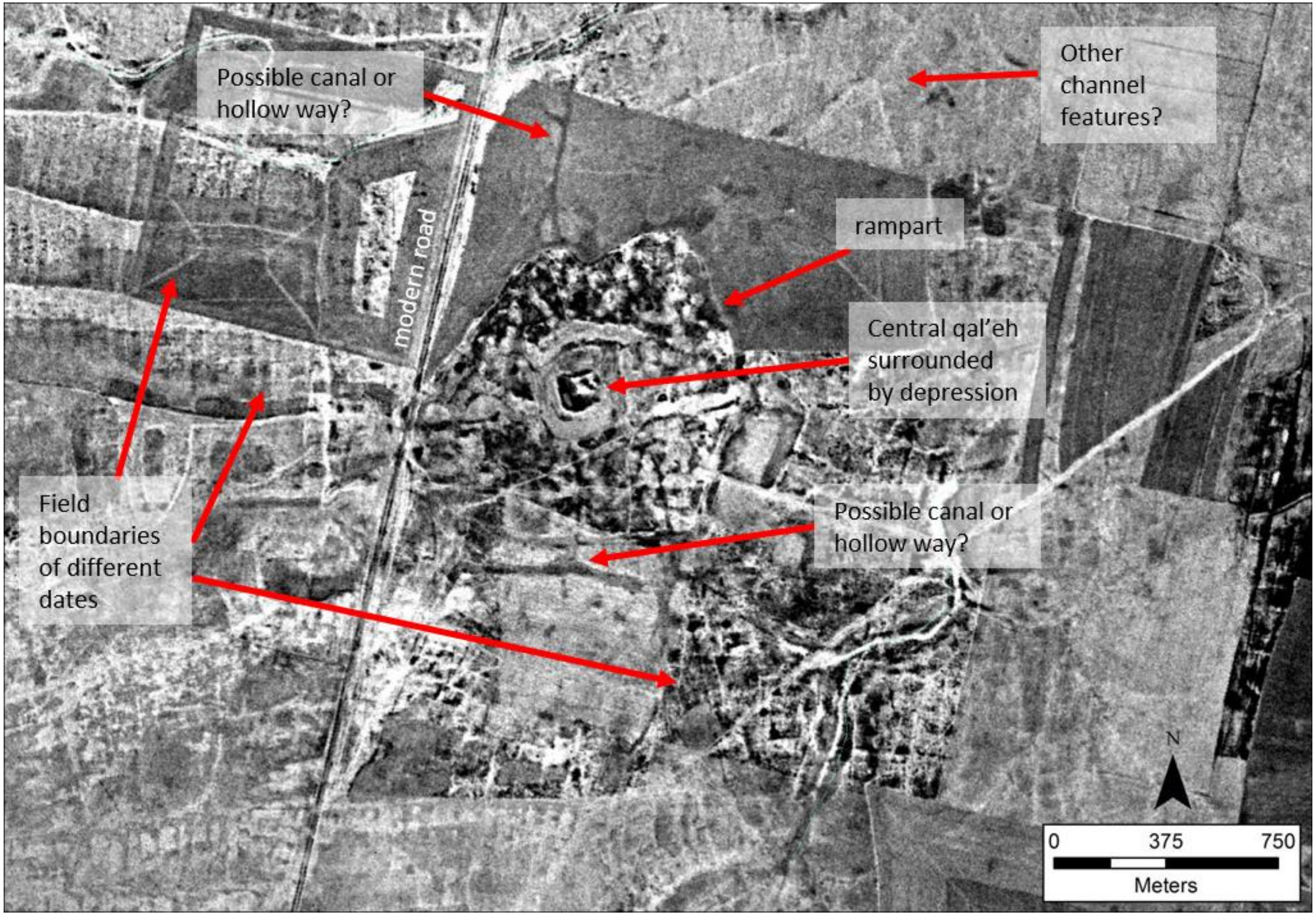


Figure 6-4: Locations of sites assigned to the Neolithic, Chalcolithic, Bronze Age, or general Prehistoric period, as well as sites in which painted pottery (indicating prehistoric painted wares) was found. Data from Abbasi 2011, Arne 1945, Kiani 1982b, Shiomi 1976 and 1978, and Wilkinson et al. 2013. Data on environmental zones derived from the 'Regional Map of Land Resources and Potentialities: Gorgan Region – East Mazanderan 1968'). Base map Landsat 7 (available from the US Geological Survey).

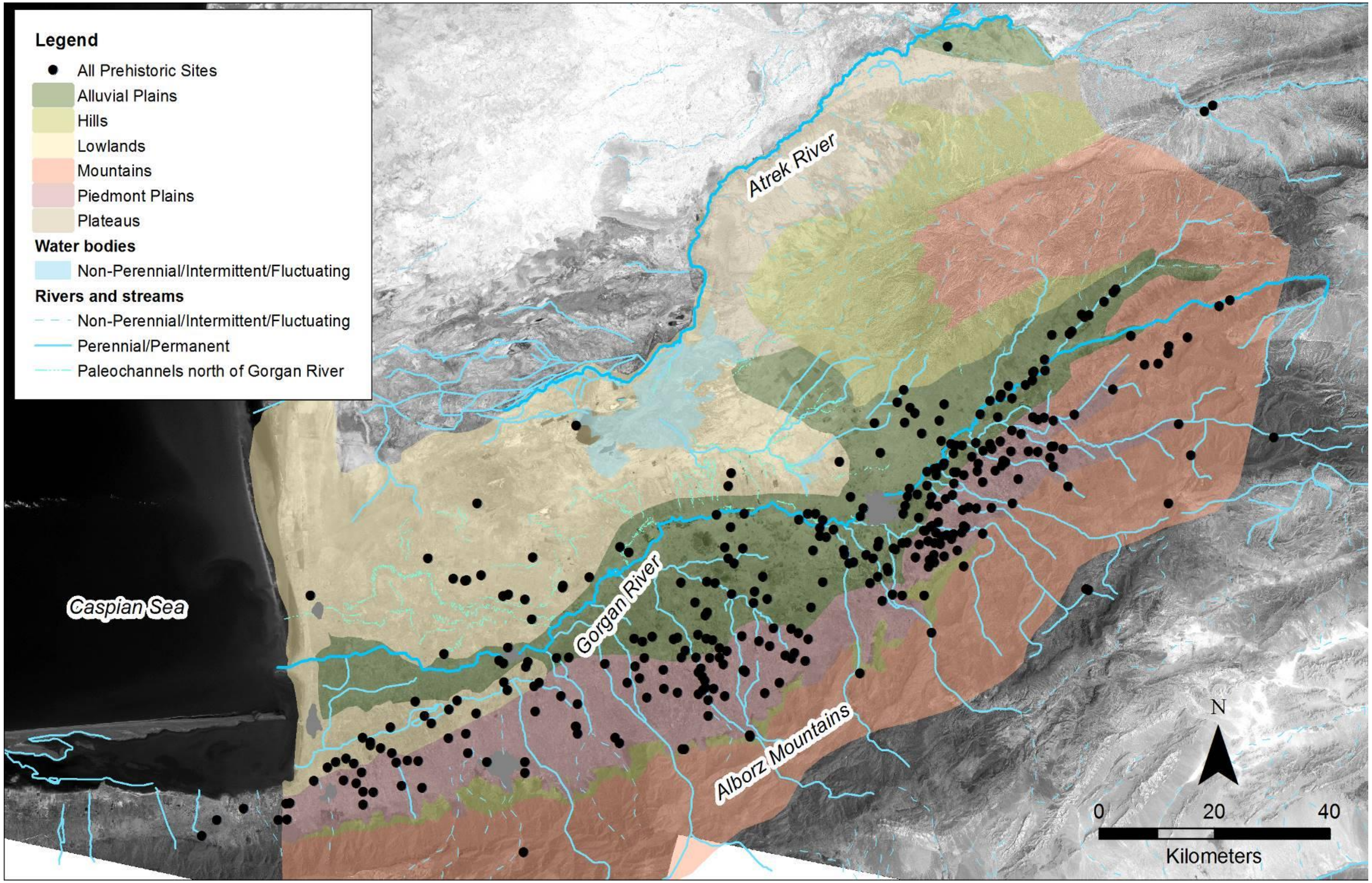


Figure 6-5: Map of Archaeological sites in the Western Steppe. The numbered sites were surveyed by the *GWS* and are discussed in the text.

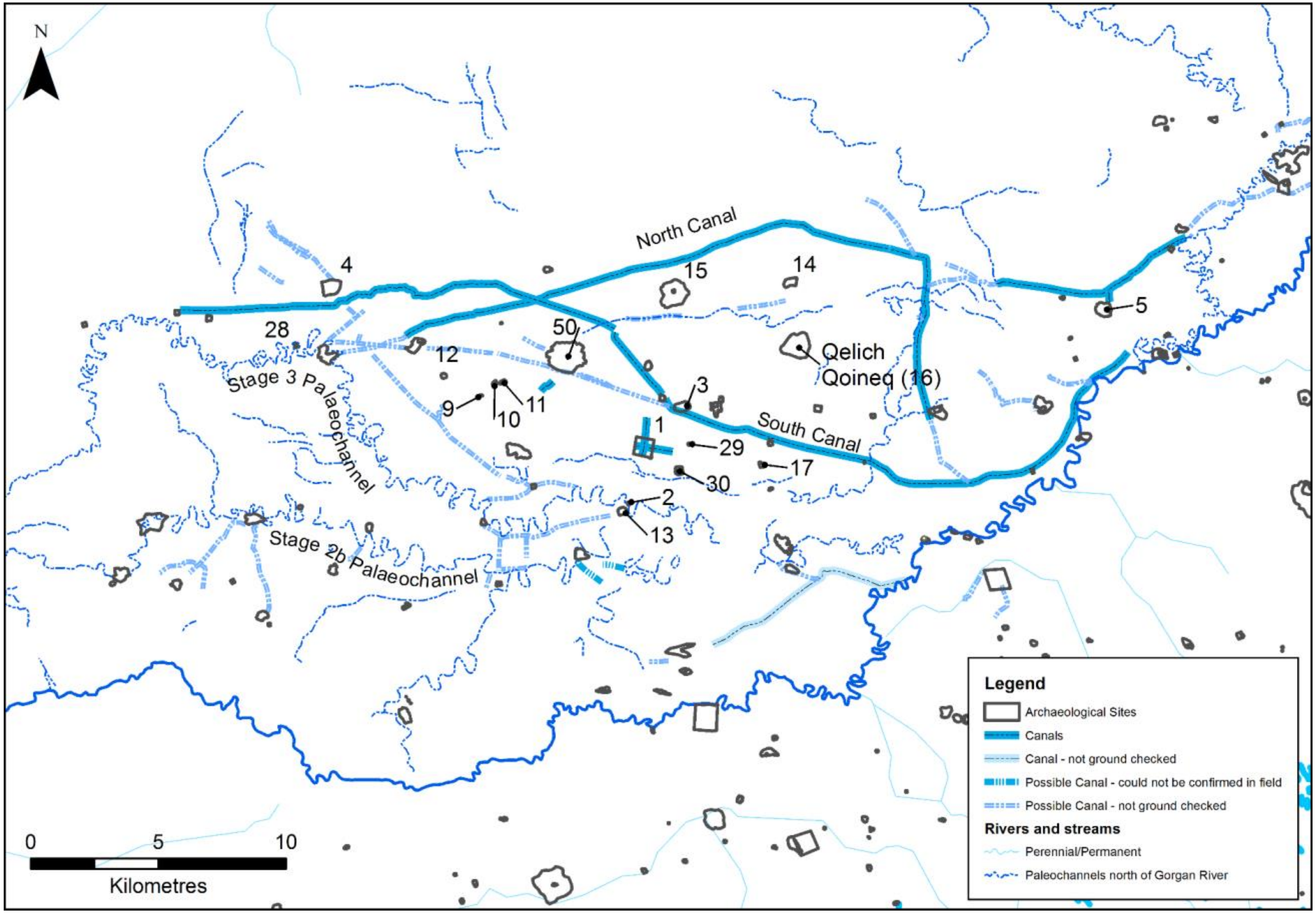


Figure 6-6: Iron III/IV-Parthian Sites in the Western Steppe on the CORONA imagery – A) GWS_30, B) GWS_3, C) GWS_15, D) GWS_5, E) GWS_50, F) GWS_4 (Imagery available from the US Geological Survey).

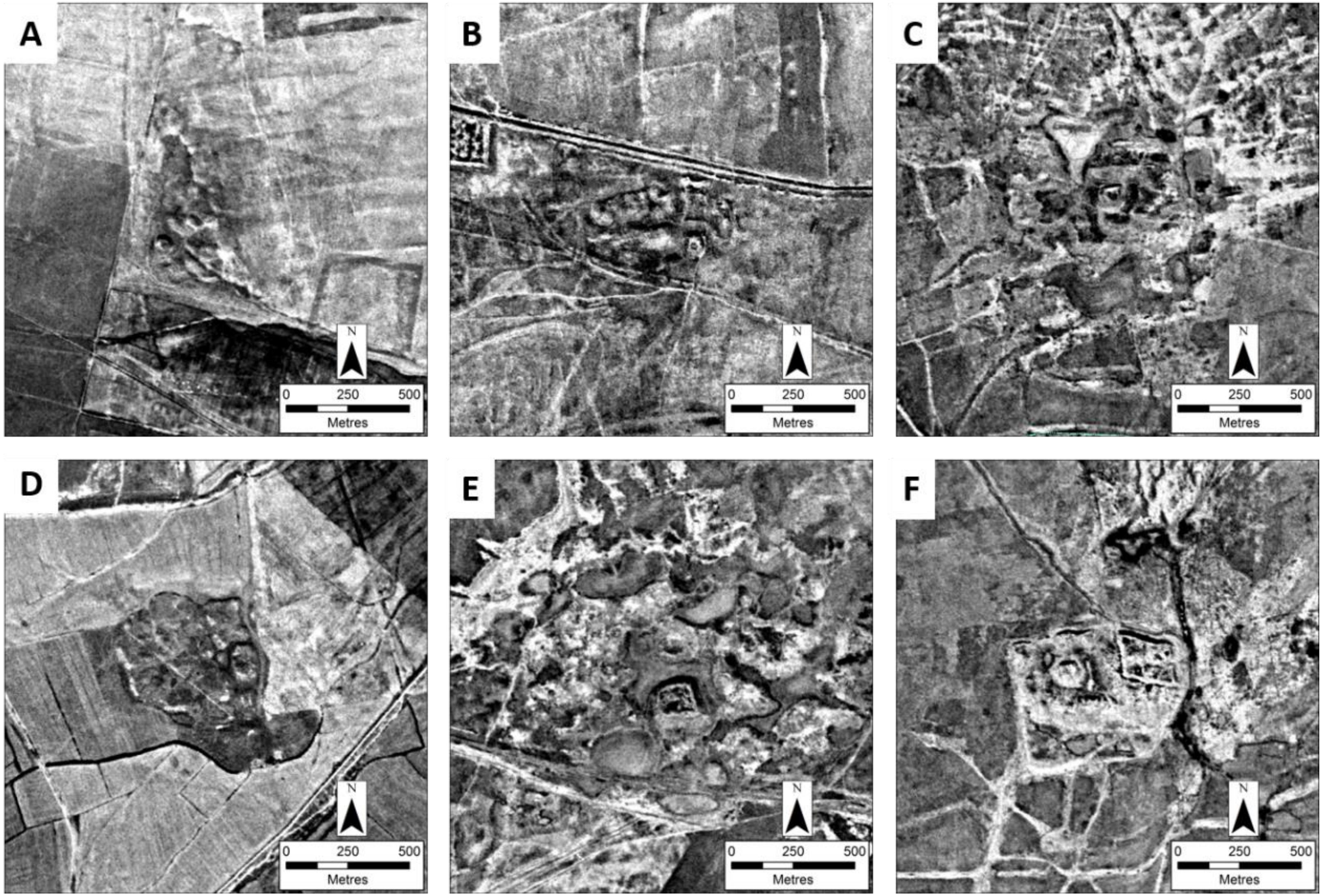


Figure 6-7: Example of an Ancient Dehistan site (after Kohl 1984: Fig. 24).

Image redacted due to copyright

Table 6-8: Proposed stages of the Gorgan River (data from Wilkinson et al. 30-32)

STAGE	LOCATION	DATING
4	Roughly following the modern channel of the Gorgan River and passes through Aq Qal'eh on its way west to enter the Caspian Sea c. 5km north of the Miankaleh spit (as it was in the 1960s on the CORONA imagery).	Active at least since the Safavid Period (AD 1501 – 1722) attested by the bridge at Aq Qal'eh. According to historical maps (Napier & Ahmed 1876; Marvin 1881: see Wilkinson et al. 2013: 32) the river veered north from its current course several miles distance from Aq Qal'eh and ran through the town of Gomish Tappeh. However, an older branch continuing on a route, roughly due west from Aq Qal'eh sometimes still flowed.
3	North of the current course of Gorgan river, and much closer to the Gorgan Wall.	Its proximity to the wall, and the placement of a Sasanian (GWS-2) and an Ilkhanid (GWS-28) in meander loops of the river (apparently for defensive purposes) suggests that it was active during these periods.
2	Two possible phases have been proposed: a) A northern branch may have flowed to the north of the Stage 3 channel, eventually joining it b) A southern branch may have flowed between the Stage 3 and 4 channels detailed above	Suggested to date to sometime in the Mid to Late Holocene perhaps until the Parthian period.
1	"Dendritic" channels heading north northwest from the area of the modern Gorgan River. There may have been many different sub-stages.	The Gorgan Wall and other hydraulic features associated with the Sasanian period have been built over these channels suggesting they were active in a much earlier period. These features end in a depression possibly representing a Late Quaternary transgression of the Caspian Sea.

Figure 6-8: Palaeochannels of the Gorgan River in the western steppe digitised on the CORONA imagery (imagery available from the US Geological Survey).

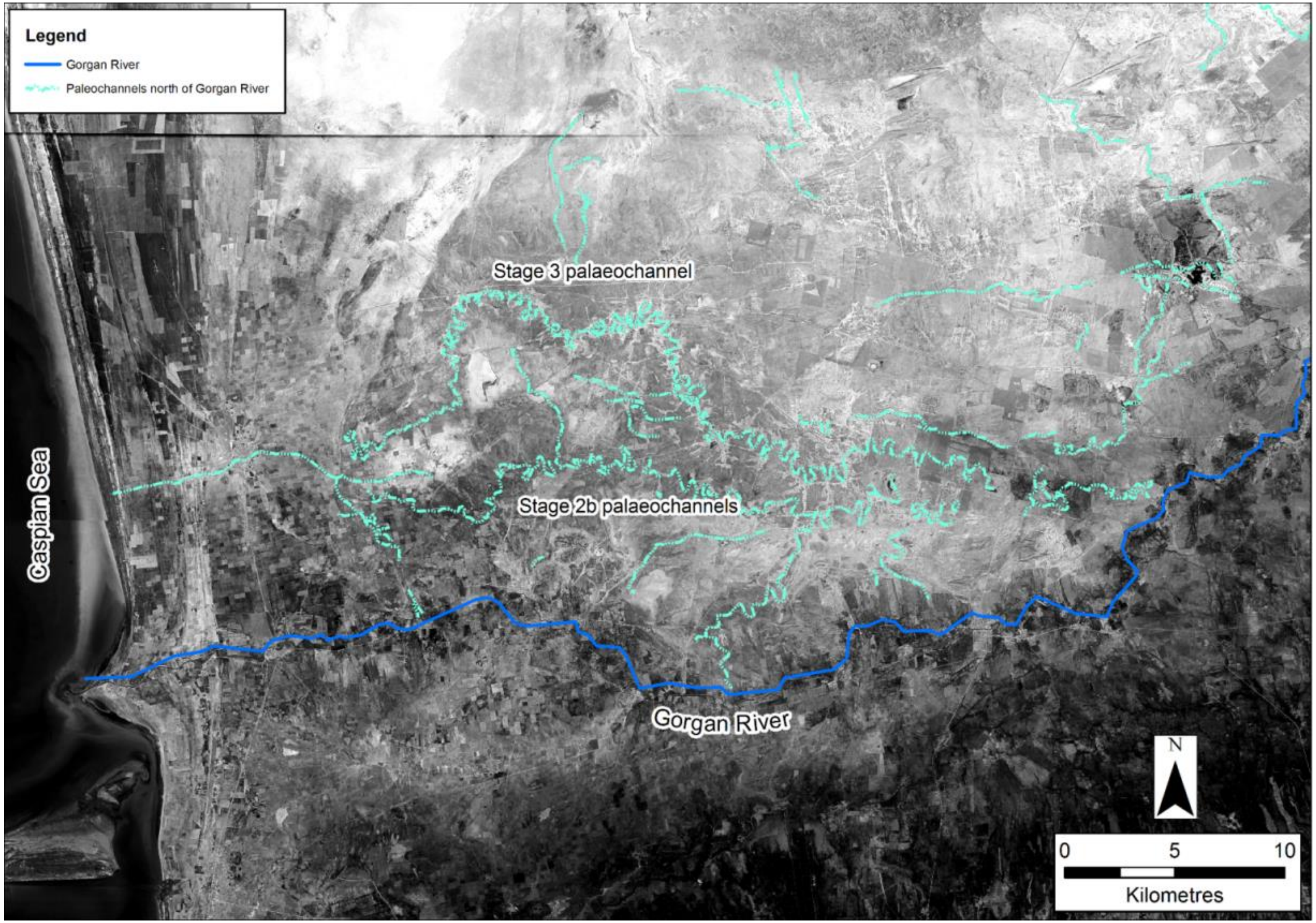


Figure 6-9: Palaeochannels associated with the proposed 2b and 3 phases of the Gorgan River in the Western steppe. Note the traces of possible irrigation channels cut by the Stage 3 channel (imagery available from the US Geological Survey).

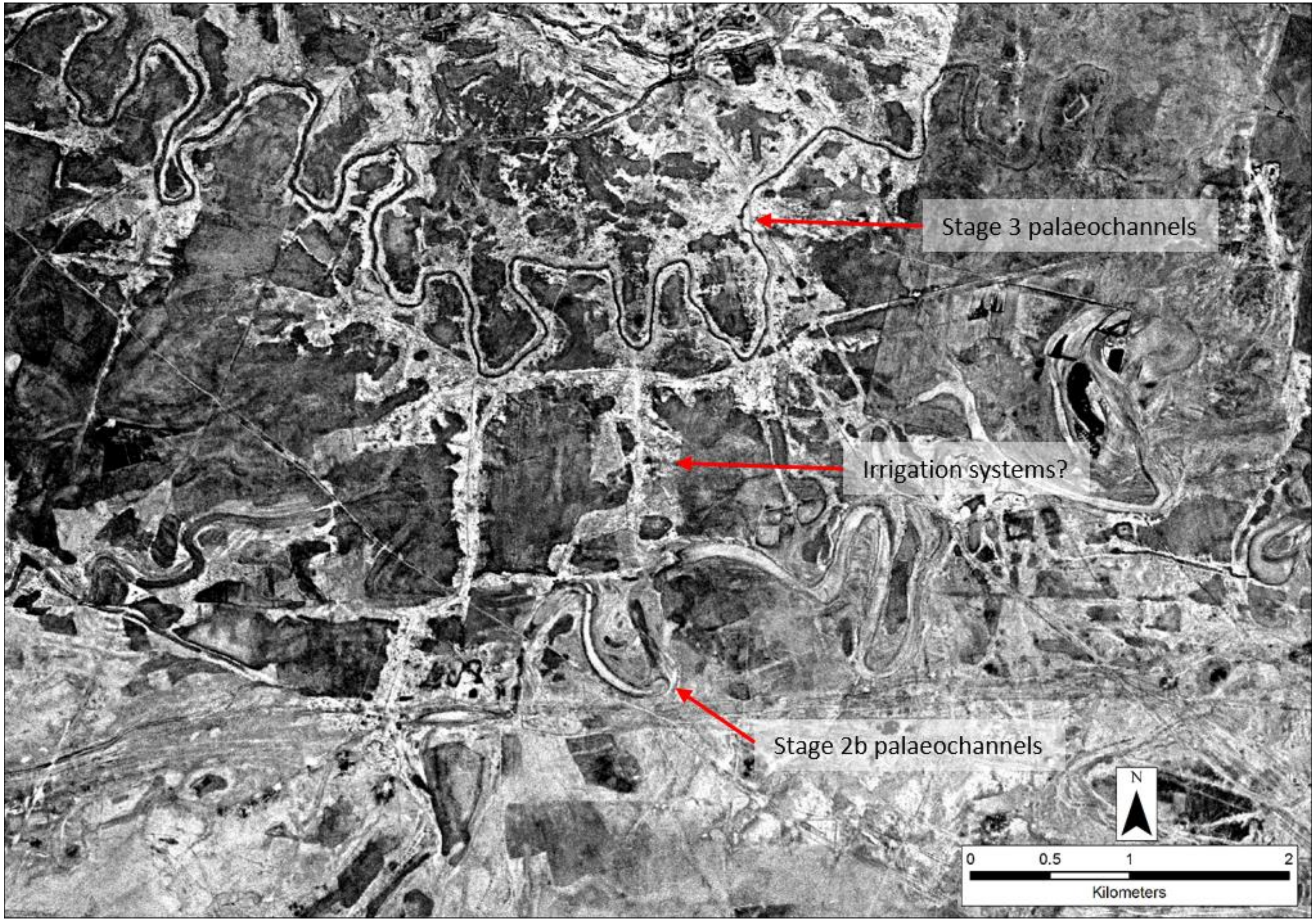


Table 6-9: Sites along the course of the Stage 2b palaeochannels. Coordinates are in UTM 40 N.

DATABASE PARENT ID	SIZE (CORONA UNLESS OTHERWISE SPECIFIED)	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	DATING INFORMATION	EASTING	NORTHING
KH_174	c. 25 ha ?	Complex topographic mound with lower outer mounding? Another prominent ovoid mound is located to the southwest on the other side of the palaeochannel.	The main body of the site is located within a meander of one of the stage 2b palaeochannels, with a further mound is located on the south side of the channel.	Iron Age III/IV, Parthian (Abbasi 2011)	250841	4104254
KH_175	Up to c. 56 ha?	Rectilinear qal'eh with lower outer mounding. Boundaries of the site are difficult to determine.	Completely surrounded by meanders of one of the Stage 2b palaeochannels. Difficult to ascertain whether it was built in the loops of the channel or the channel cut through parts of the site at some point without ground-truthing. Relict field systems immediately to the north.	Iron Age III/IV, Parthian, Islamic (Abbasi 2011)	252054	4106362

DATABASE PARENT ID	SIZE (CORONA UNLESS OTHERWISE SPECIFIED)	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	DATING INFORMATION	EASTING	NORTHING
KH_197	c. 21 ha	Prominent mound surrounded by low outer mounds. Boundaries of the site are difficult to determine within the palimpsest of landscape features in the area.	A 2b palaeochannel surrounds the site to the north and east. Difficult to determine, but the channel does not appear to cut the outer mounds of the site. Two possible irrigation channels run from the palaeochannels in the vicinity of the site toward the south and KH_198, and KH_118/KH_143 (see below).	No dating information. CORONA only.	256048	4106510
KH_198	c. 9.5 ha	Complex topographic mound.	Fields in the vicinity possible recipients of water from Stage 2b palaeochannel.	No dating information. CORONA only.	253034	4103917
KH_143/ KH_118	c.12 ha/ 1ha	Upper and lower qal'eh site (KH_143) , with a square qal'eh (KH_118) c. 250 m to the SE. Difficult to tell if the two sites are related.	KH_143 appears to be at the end point of the channel/canal that extends from the Stage 2b palaeochannel next to KH_197.	Red brown polished pottery (Shiomi 1976); no dating information for KH_118.	256383 256657	4102702 4102359
ARNE_124	c. 2ha	Circular or ovoid tappeh.	C 100m north of the 2b palaeochannel. No indications that the channel has impacted the site.	No dating information. Brick noted in HUS Survey (Shiomi 1976).	257867	4106963

DATABASE PARENT ID	SIZE (CORONA UNLESS OTHERWISE SPECIFIED)	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	DATING INFORMATION	EASTING	NORTHING
ARNE_125	c. 6 ha	Complex topographic mound. Pitted appearance may be the result of looting of the mound.	Immediately north of a meander of one of the stage 2b palaeochannels.	Red brown pottery (Shiomi 1976-78); Iron Age III/IV (Abbasi 2011)	260576	4106153
ARNE_140	At least 9 ha	Complex of low mounds.	Possible canal-like or channel feature extending toward the site from the Stage 2b palaeochannel.	Red brown pottery (Shiomi 1976-78); Iron Age III/IV and Islamic (Abbasi 2011)	259157	4104501
ARNE_147	c. 3 ha	Complex of low mounds. Boundaries of the site are quite diffuse.	Stage 2b palaeochannel runs c. 150m to the south of the site. Possible irrigation channel also associated with one of the 2b iterations of the River (part of a larger grid?) located to the west.	Red brown polished pottery (Shiomi 1976-78)	265720.	4103963

DATABASE PARENT ID	SIZE (CORONA UNLESS OTHERWISE SPECIFIED)	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	DATING INFORMATION	EASTING	NORTHING
KH_144/ NTS_104	c. 19ha/ c. 0.5 ha	Complex topographic mound or mounds (KH_144), with at least three small mounds to the northeast (NTS_104).	Along what appears to be one of the stage 2b channels that flows south from the vicinity of ARNE_147. It fades out before reaching the Stage 3 channel. Traces of multiple other palaeochannels are also visible in the vicinity.	KH_144 - Red polished pottery (Arne 1945); red brown polished pottery (Shiomi 1976); Iron Age III/IV, Parthian and Islamic (Abbasi 2011) NTS_104 – EBA, Iron Age III/IV, Parthian and Sasanian.	261968	4098803
KH_151	c. 16 ha	Prominent square qal'eh with lower mounding to the east and north east.	Enclosed within a bend of one of the stage 2b palaeochannels. A least two versions of the relict meander in which it is enclosed are visible. Possible canal-like features may extend into fields beyond the site.	Red brown-polished pottery (Shiomi 1976-78); Iron Age III/IV, Parthian and Sasanian (Abbasi 2011)	268843	4105108

Figure 6-10: Sites along the Stage 2b palaeochannels. Sites labelled with numbers only are *GWS* sites.

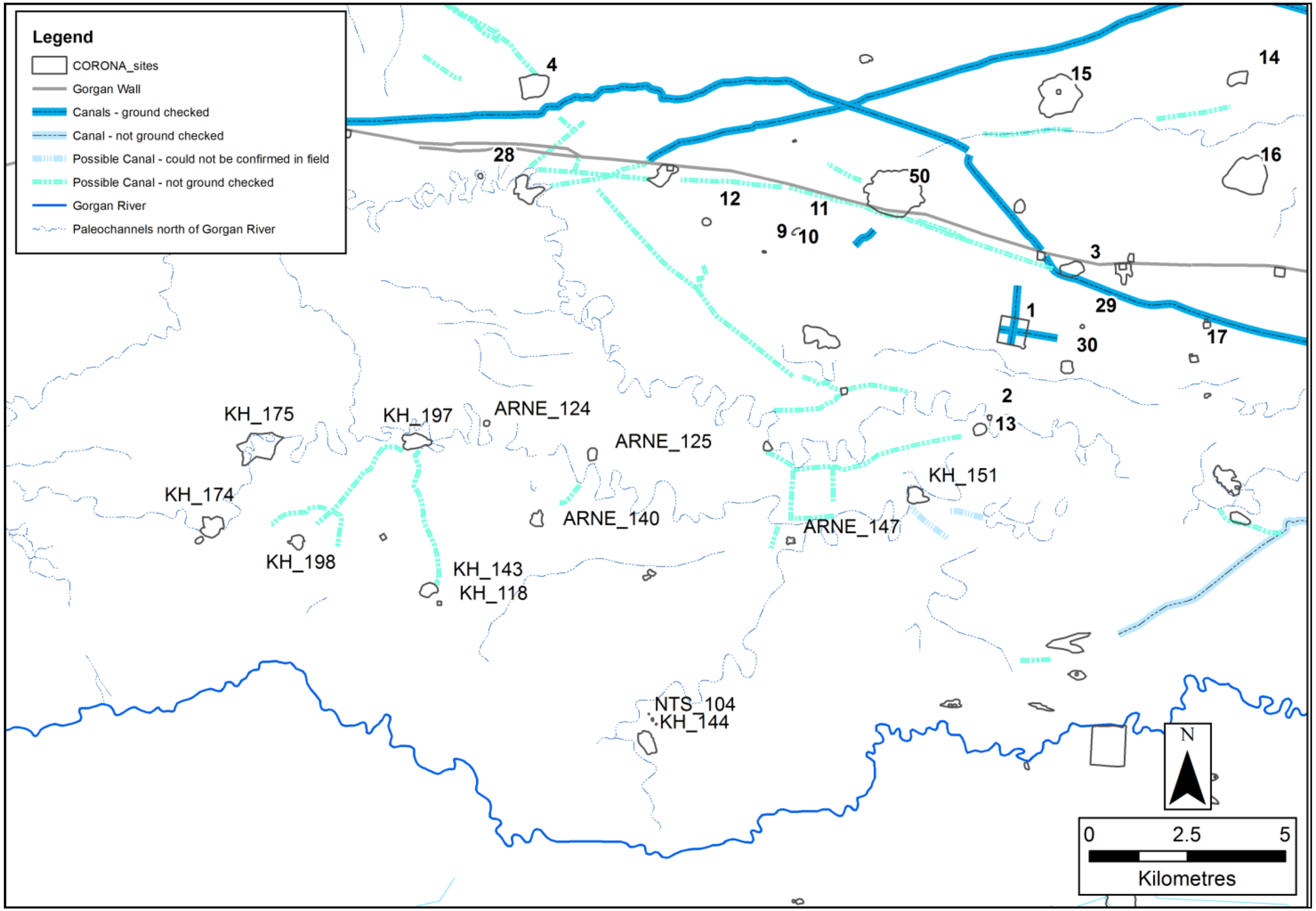


Table 6-10: Sites identified on the CORONA imagery north of the Gorgan River in the western steppe (not discussed in Table 6-9) with morphological characteristics associated with Iron Age III through Parthian sites in the steppe margins. Coordinates are in UTM 40N.

DATABASE PARENT ID	SIZE (CORONA UNLESS OTHERWISE SPECIFIED)	DESCRIPTION	ASSOCIATED LANDSCAPE FEATURES	DATING INFORMATION	EASTING	NORTHING
ARNE_135	c. 7 ha	Depression, Complex Topographic Mound	Western steppe, north of Aq Qal'eh. Immediately north of the modern Gorgan River, but no clear association.	Grey and red-brown polished pottery (Shiomi 1976-78); Arne (1945) indicated Islamic pottery; Chalcolithic, EBA and Iron III/IV (Abbasi 2011)	272964	4100535
ARNE_146	c. 7 ha	Complex of Low Mounds, Lower Town	Western steppe, Immediately north of the modern Gorgan River, but no clear association.	Red-brown polished pottery (Shiomi 1976-78)	269779	4099781
ARNE_75	c. 27 ha	Qal'eh with outer mounds, Complex of Low Mounds	Western steppe. Associated with a palaeochannel related to the Stage 2 phases?	Prehistoric, red sherds (Arne 1945); red-brown polished pottery (Shiomi 1976-78)	277034	4105319
HUS_1	At least c. 2 ha (Shiomi 1976), but potentially up to c. 28 ha	Complex of Low Mounds	In the western steppe, within several loops of the stage 3 palaeochannel. The site boundaries are rather difuse and therefore it is difficult to ascertain the relationship between the site and the channel	Red brown pottery; red brown polished pottery (Shiomi 1976-78);	258753	4113141

KH_13	c. 3 ha including depression around qal'eh, and potentially us to at least c. 17 ha.	Qal'eh with outer mounds, Depression	Western Steppe. Within a relict meander of the Gorgan River, south of Fort 23. The modern river appears to cut the site to the south. Numerous archaic field systems are visible in the vicinity.	N/A	291482	4112972
HUS_118	At least c. 8 ha (Shiomi 1976), but possibly up to 34 ha.	Complex of Low Mounds	Western steppe. Immediately north of a palaeochannel possibly associated with Stage 2a. Archaic field systems are visible in the immediate vicinity.	Red brown polished pottery (Shiomi 1976-78); Iron Age III/IV, Parthian and Islamic (Abbasi 2011)	266385	4109159

Figure 6-11: Canals in the Western Steppe. Numbers indicate *GWS* sites, letters indicate locations and features mentioned in the text.

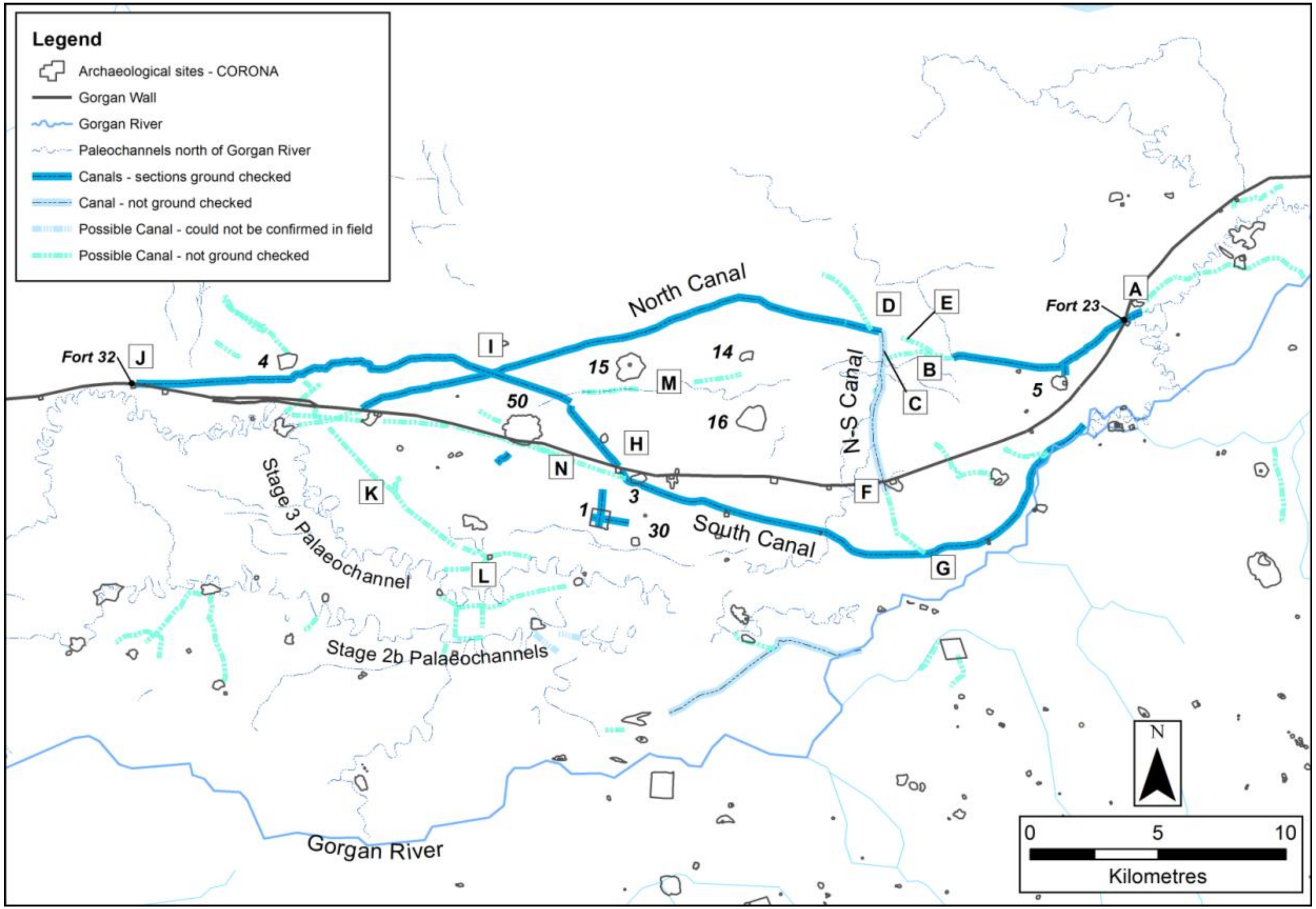


Figure 6-12: Canals in relation to topography. Imagery SRTM 90m DEM (Imagery available from the US Geological Survey).

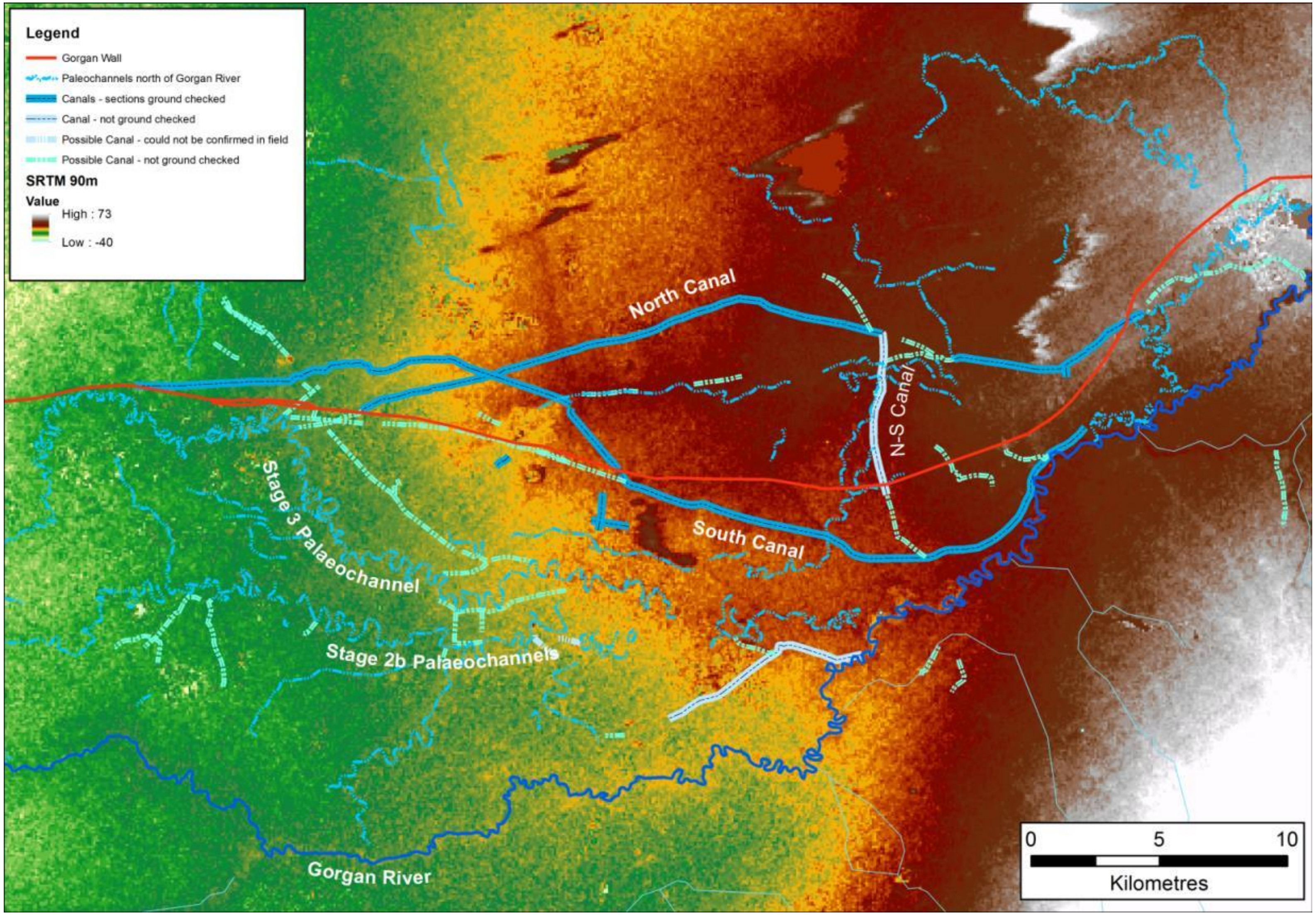


Table 6-11: Sites located in the Central Steppe subzone, along with dating evidence and assessment of site certainty (archaeological significance).

PARENT_ID	SIZE	MORPHOLOGY (FROM IMAGERY AND FIELD DERIVED DATA WHERE AVAILABLE – DISCEPANCIES NOTED)	DATING	EASTING	NORTHING	SITE CERTAINTY (FOR CORONA ONLY SITES)
ARNE_12	1500 m, H= 11 m (Arne 1945) c. 4.7 ha (Kiani 1982b) Up to c. 64 ha, but this may include remains of field systems and other features (CORONA)	Ovoid tappeh recorded by Arne (1945), but appears as a complex of at several low mounds, and soil colour difference on the CORONA imagery cut by a modern linear feature. Map feature only on the Kiani map (1982b), but appears to indicate a group of mounds.	Islamic (Arne 1945)	296617	4120619	Definite
KH_10	c. 2.7 ha qal'eh with overall site c. 18 ha (CORONA). Kiani (1982b) map gives similar dimensions. 80 m x 80 m, H = 11m (Arne 1945)	Rectilinear qal'eh (Arne 1945, Kiani 1982b) with lower site identified on the CORONA imagery and the Kiani (1982b) maps.	Islamic (Arne 1945)	296373	4119526	Definite
KH_67	< 1 ha (CORONA)	Ovoid tappeh recorded on the CORONA imagery.	none	315731	4123975	High
KH_86	Tappeh < 1 ha, with overall site up to c. 2 ha? (CORONA)	Circular tappeh, with surrounding soil colour difference (CORONA)	none	305480	4130927	Medium
KH_87	50-75 m in diameter (CORONA)	Circular features (x3) surrounded by depressions? (CORONA)	none	306654	4130682	Medium

PARENT_ID	SIZE	MORPHOLOGY (FROM IMAGERY AND FIELD DERIVED DATA WHERE AVAILABLE – DISCEPANCIES NOTED)	DATING	EASTING	NORTHING	SITE CERTAINTY (FOR CORONA ONLY SITES)
KH_88	c. 1.5 ha (CORONA)	Rectangular/square enclosure (CORONA).	none	302904	4123545	Low
KIA_11	c. 2 ha (Kiani 1982b)	Not visible on the CORONA imagery; rectilinear map feature (Kiani 1982b)	none	253196	4116172	Low
KIA_13	Overall site c. 12 ha (Kiani 1982b) with similar size indicated on the CORONA imagery (c. 13.7 ha)	Complex of mounds including large flat roughly rectilinear mound with citadel and smaller outlying mounds visible on the CORONA and on Kiani (1982b) map.	none	291683	4122092	High
KIA_15	c. 4.4 ha (CORONA) c. 3.5 ha (Kiani 1982b)	Ovoid tappeh or mounded structure indicated as a map feature on Kiani (1982b) map; irregular tappeh visible on CORONA image.	none	293740	4122081	Medium
KIA_16	c. 3 ha (Kiani 1982b)	Not visible on the CORONA imagery; map feature (Kiani 1982b)	none	293792	4118913	Medium
KIA_20	c. 1.2 ha (Kiani 1982b)	Not visible on the CORONA imagery; map feature, likely a tappeh or mounded structure (Kiani 1982b)	none	305068	4122765	Low
KIA_21	< 1 ha (CORONA and Kiani 1982b)	Tappeh or mounded structure indicated as a map feature (Kiani 1982b), with a circular tappeh visible on the CORONA imagery.	none	305644	4125203	Medium

PARENT_ID	SIZE	MORPHOLOGY (FROM IMAGERY AND FIELD DERIVED DATA WHERE AVAILABLE – DISCEPANCIES NOTED)	DATING	EASTING	NORTHING	SITE CERTAINTY (FOR CORONA ONLY SITES)
KIA_22			none	305729	4127180	High
KIA_23		Not visible on the CORONA imagery; map feature (Kiani 1982b)	none	307704	4126949	High
KIA_24	c. 9 ha (CORONA) c. 11 ha (Kiani 1982b)	Complex of low mounds visible on the CORONA imagery; also indicated as a map feature by Kiani (1982b).	none	304968	4129490	High
KIA_25	c. < 1 ha (CORONA) c. 1 ha (Kiani 1982b)	Ovoid tappeh visible on the CORONA imagery and indicated on the Kiani (1982b) map.	none	308536	4125673	High
KIA_26	c. 6.3 ha (CORONA) c. 18 ha (Kiani 1982b)	Complex of low mounds indicated as a map feature by Kiani (1982b), while at least two low mounds are visible on the CORONA image.	none	309928	4126167	Medium/High
KIA_27	c. up to 39 ha (CORONA) c. 3.7 ha (Kiani 1982b)	Group of low discrete mounds suggested by the Kiani (1982b) map, while the CORONA shows a complex of low mounds, and a soil colour difference.	none	314599	4128800	Medium/High
KIA_28	c. 1 ha (Kiani 1982b and CORONA)	Rectangular/square enclosure indicated on Kiani (1982b) map, and is also visible on the CORONA image.	none	316928	4125229	High
KIA_29	c. 7.8 ha (Kiani 1982b)	Not visible on the CORONA imagery; map feature only (Kiani 1982b)	none	321001	4124357	Low

Figure 6-13: Archaeological sites north of the Gorgan River in the central steppe. The base map is a colour infrared Landsat image illustrating the networks of irrigation channels and palaeochannels extending off the river (imagery available from the US Geological Survey).

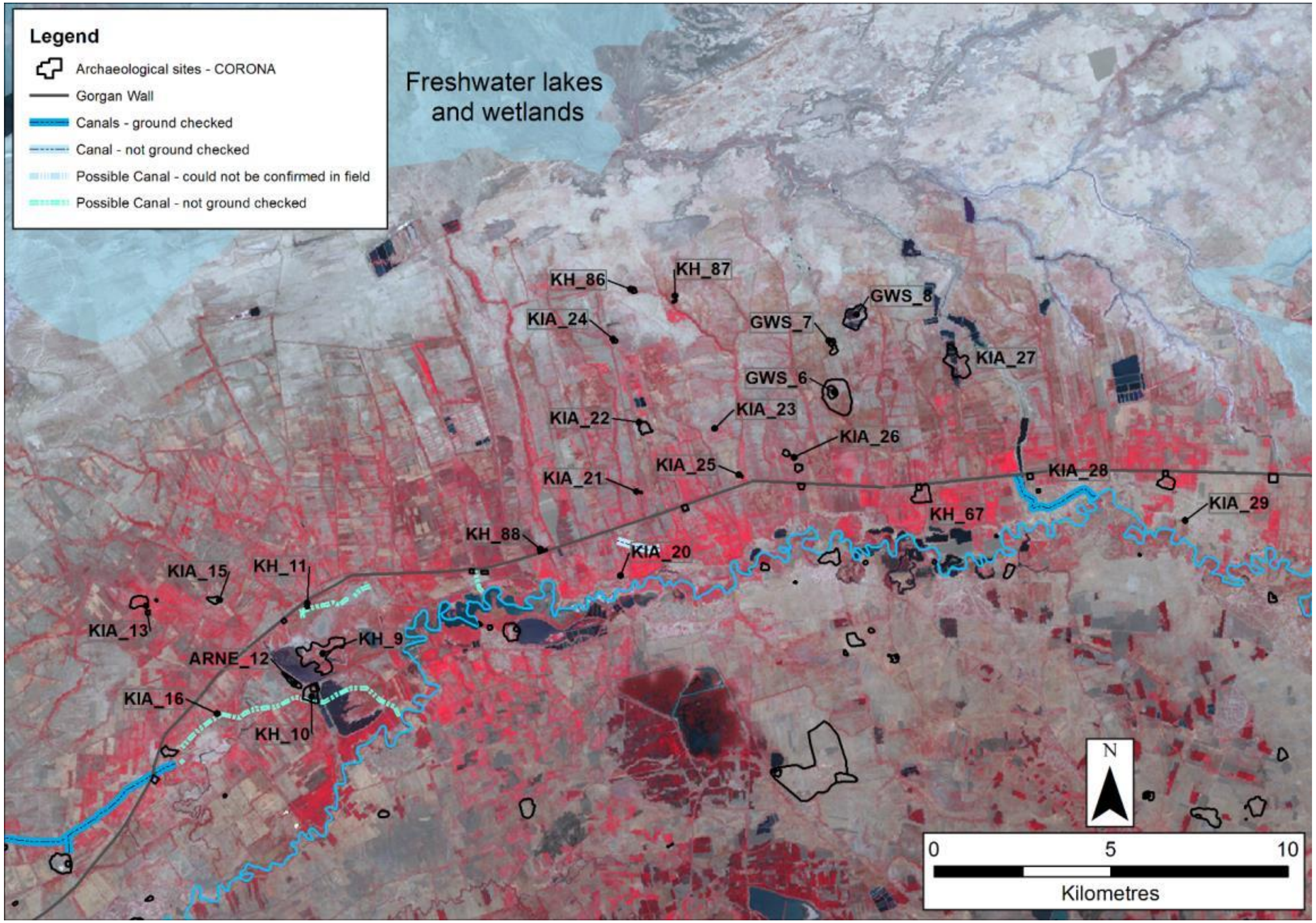


Figure 6-14: Sites in the eastern dry-farming zone group one. Sites in bold are visible on the CORONA imagery.

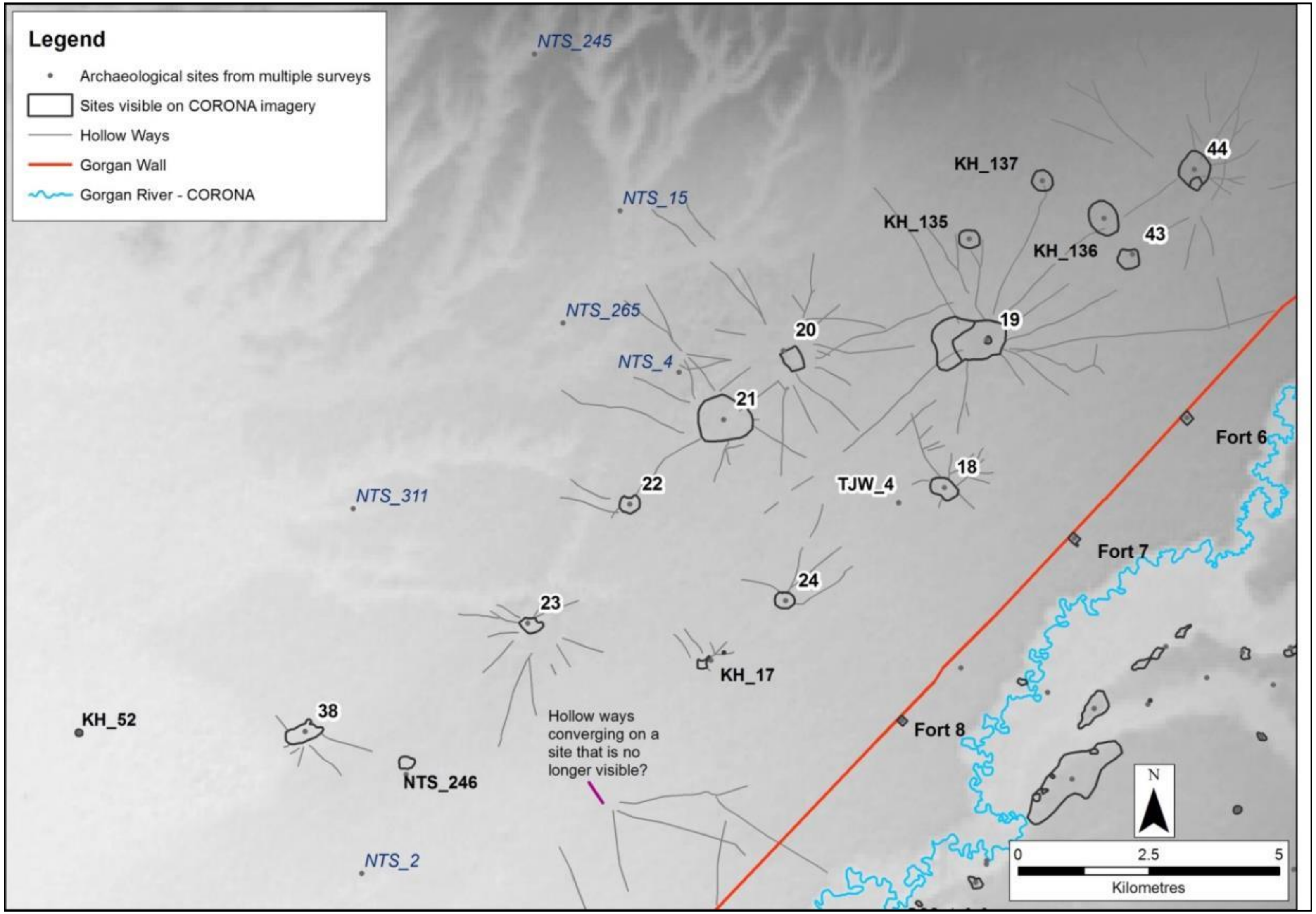


Figure 6-15: A) GWS_18, B) GWS_19, C) GWS_22, D) GWS_24, E) GWS_43.

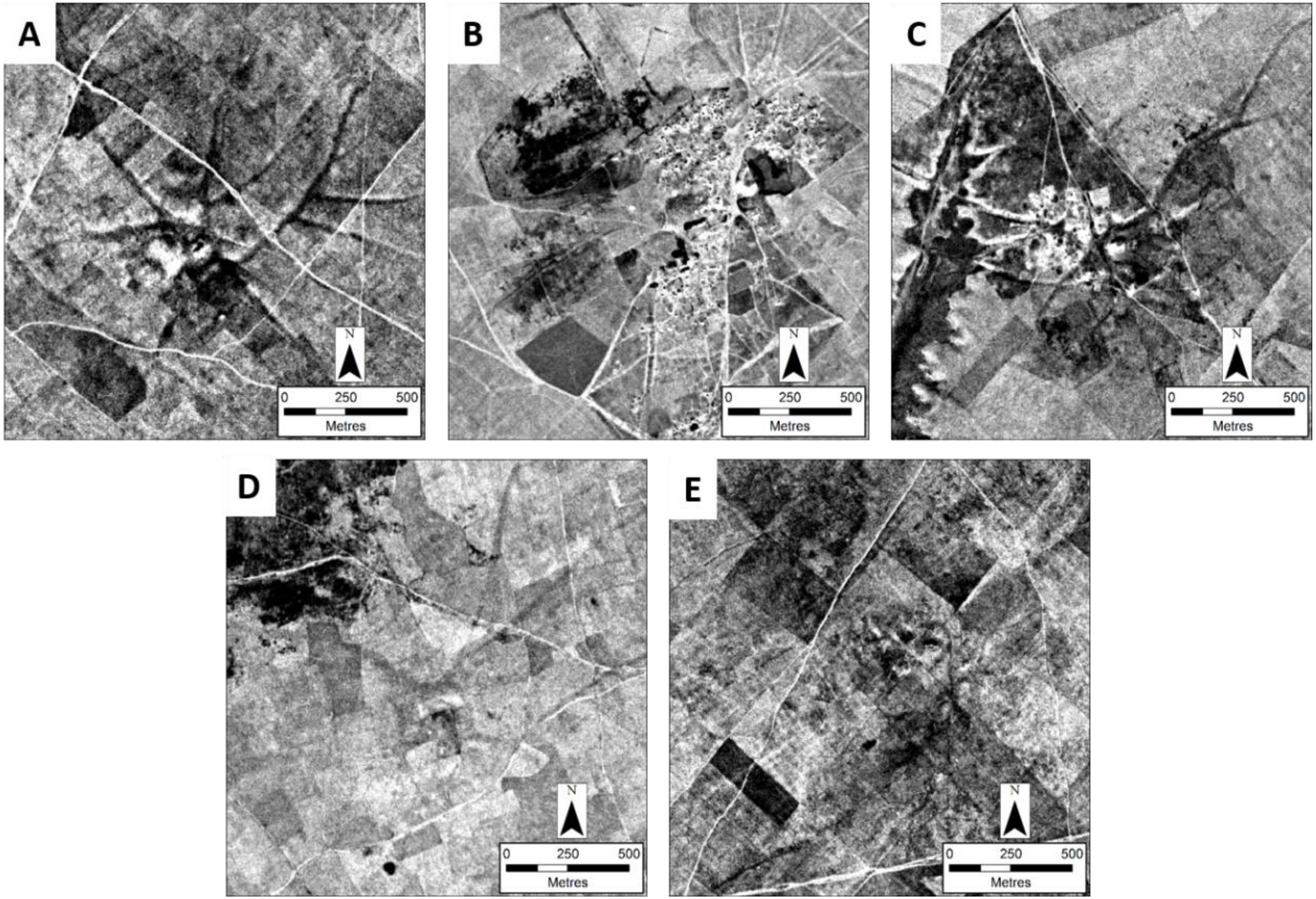


Figure 6-16: Sites in the eastern dry-farming zone with ramparts. A) GWS_20, B) GWS_21, C) GWS_23, D) GWS_38, E) GWS_44.

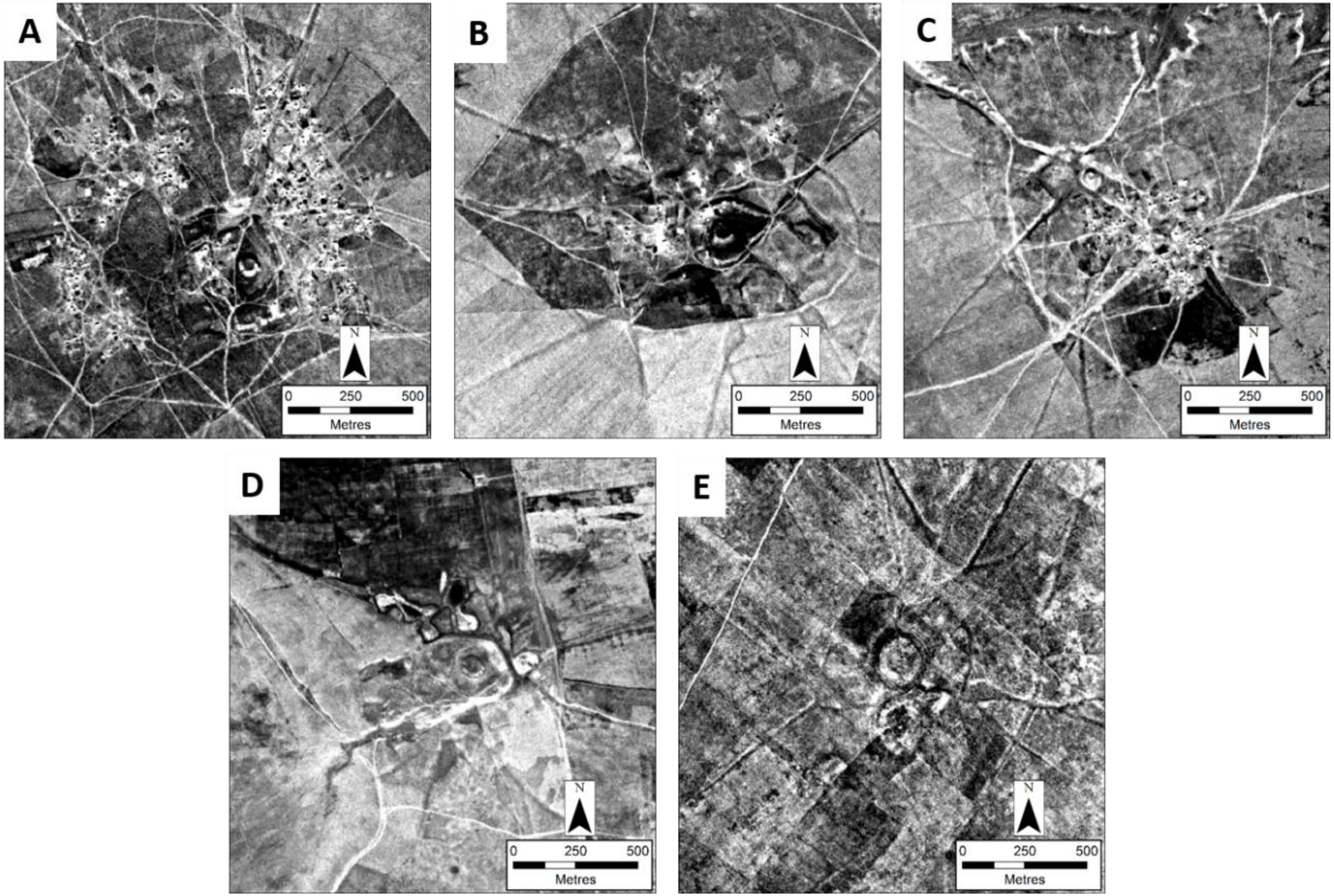


Figure 6-17: KH_17 identified on the CORONA imagery.

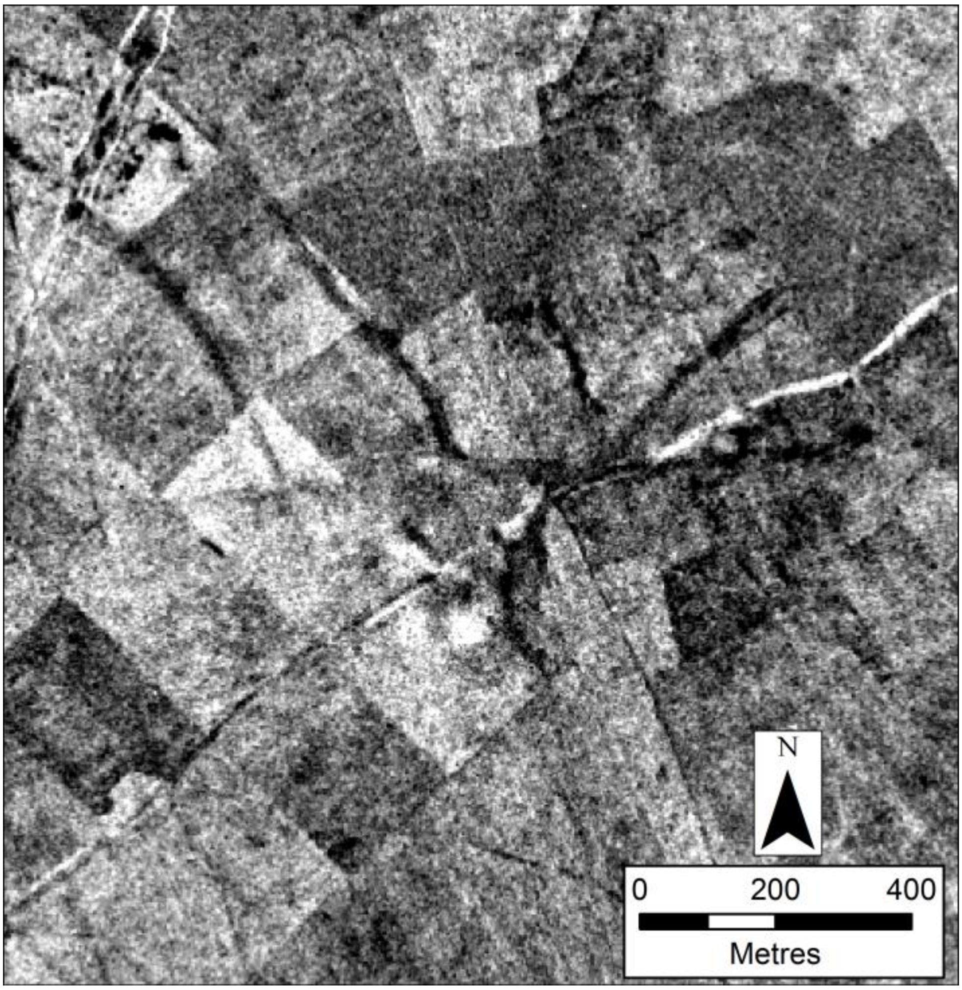


Table 6-12: Dating of sites in the eastern dry farming zone (group one) that have associated hollow ways.

DATABASE PARENT_ID	PREHISTORIC	IRON AGE III/IV	ACHAEMENID	PARTHIAN	SASANIAN	ISLAMIC
GWS_18	EBA (Abbasi 2011)	GWS field assessment (Iron Age III?) GWS lab assessment (Iron Age IV) Abbasi 2011	Abbasi 2011	Abbasi 2011		
GWS_19		Abbasi 2011	Abbasi 2011	GWS field assessment Abbasi 2011	GWS field assessment (not echoed in lab assessment) Abbasi 2011	GWS field assessment (Middle Islamic) Abbasi 2011
GWS_20		GWS lab assessment (Iron Age IV)		GWS field assessment	GWS field assessment (not echoed in lab assessment) Abbasi 2011	GWS field assessment (Middle Islamic) Abbasi 2011
GWS_21	Kiani 1982b (could indicate anything pre-Achaemenid including Iron Age III/IV)	GWS lab assessment (Iron Age IV)		GWS field assessment Abbasi 2011	Abbasi 2011	Kiani 1982b (Middle Islamic)

DATABASE PARENT_ID	PREHISTORIC	IRON AGE III/IV	ACHAEMENID	PARTHIAN	SASANIAN	ISLAMIC
GWS_22	Kiani 1982 (could indicate anything pre-Achaemenid including Iron Age III/IV)	GWS lab assessment (Iron Age IV) Abbasi 2011	Abbasi 2011	Abbasi 2011	Abbasi 2011	Kiani 1982b Abbasi 2011
GWS_23		GWS lab assessment (Iron Age IV) Abbasi 2011	Abbasi 2011	GWS field assessment Abbasi 2011	GWS field assessment (not echoed in lab assessment)	
GWS_24	GWS lab assessment (Bronze Age? Iron Age?)	Abbasi 2011	Abbasi 2011			
GWS_38	Kiani 1982b (could indicate anything pre-Achaemenid including Iron Age III/IV)	Abbasi 2011		GWS field assessment Abbasi 2011 Kiani 1982b		GWS field assessment Kiani 1982b Abbasi 2011
GWS_43		Abbasi 2011	Abbasi 2011	Abbasi 2011		
GWS_44				Abbasi 2011	GWS field assessment	GWS field assessment Abbasi 2011

Table 6-13: Sites located in eastern dry-farming zone group one, which were not surveyed by *GWS*, but were identified in other surveys or on CORONA imagery.

PARENT_ID	DESCRIPTION	DATING EVIDENCE	SITE CERTAINTY (ARCHAEOLOGICAL SIGNIFICANCE)
KH_135	Circular features? Very indistinct.	None	Low
KH_136			
KH_137			
KH_17	Tappeh or mounded structure with radiating hollow ways.	None	High
KH_52	Circular enclosure?	None	Low
NTS_15	Not visible on the CORONA imagery.	EBA, MBA, Achaemenid, Islamic (Abbasi 2011)	Definite
NTS_2		Islamic (Abbasi 2011)	Definite
NTS_245		Iron Age III/IV, Achaemenid and Islamic (Abassi 2011)	Definite
NTS_246	Tappeh or mounded feature.	Chalcolithic, Bronze Age, Islamic (Abbasi 2011)	Definite
NTS_265	Not visible on the CORONA imagery.	MBA, LBA, Islamic (Abbasi 2011)	Definite
NTS_311		EBA, MBA, LBA, Iron Age III/IV (Abbasi 2011)	Definite
NTS_4		EBA (Abbasi 2011)	Definite

Figure 6-18: Hollow ways extending from GWS_18, and the relationship with the hollow way extending from GWS_19.

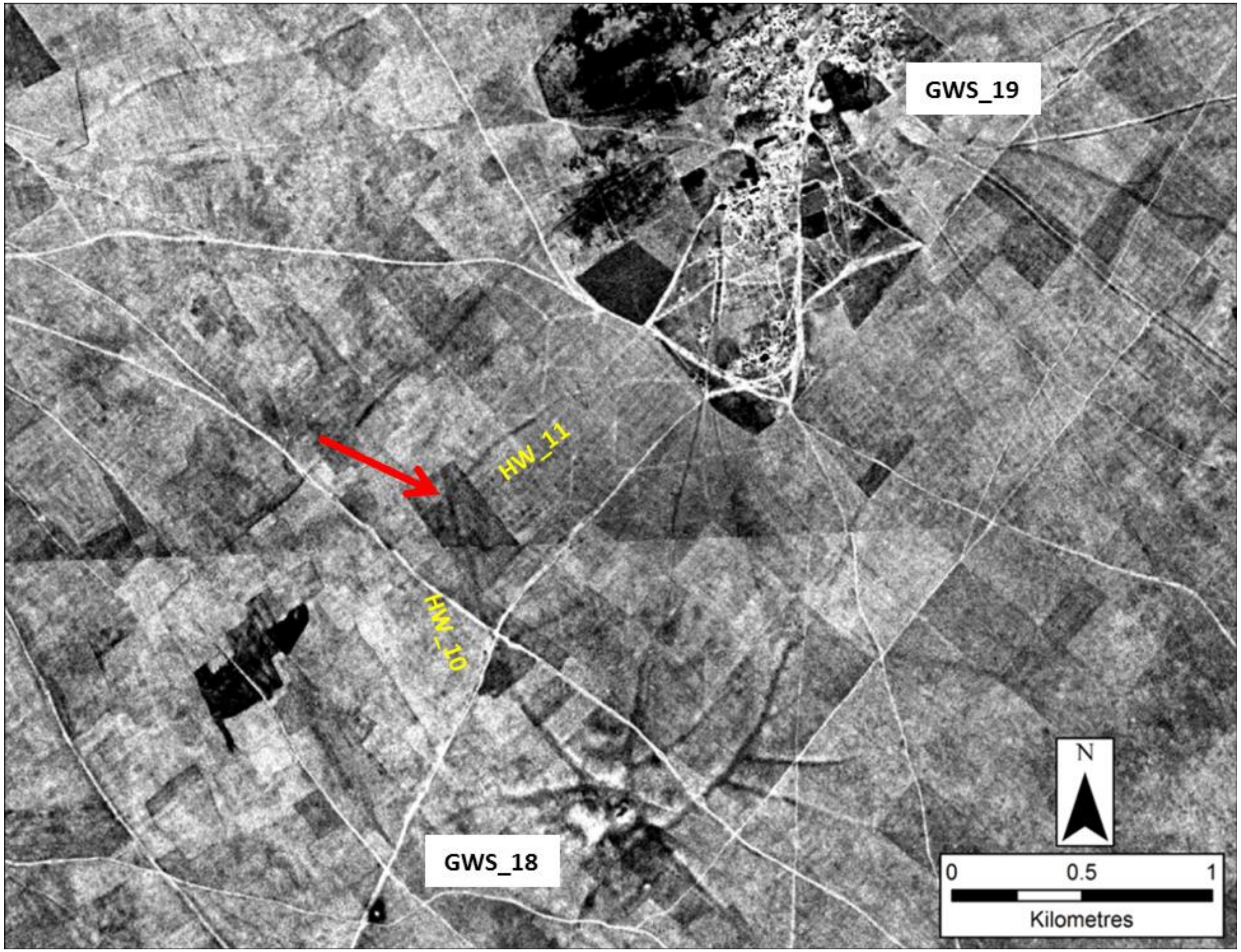


Figure 6-19: Hollow way phasing around GWS_19. The red arrows indicate where an older hollow way appears to be cut by a newer hollow way or track.

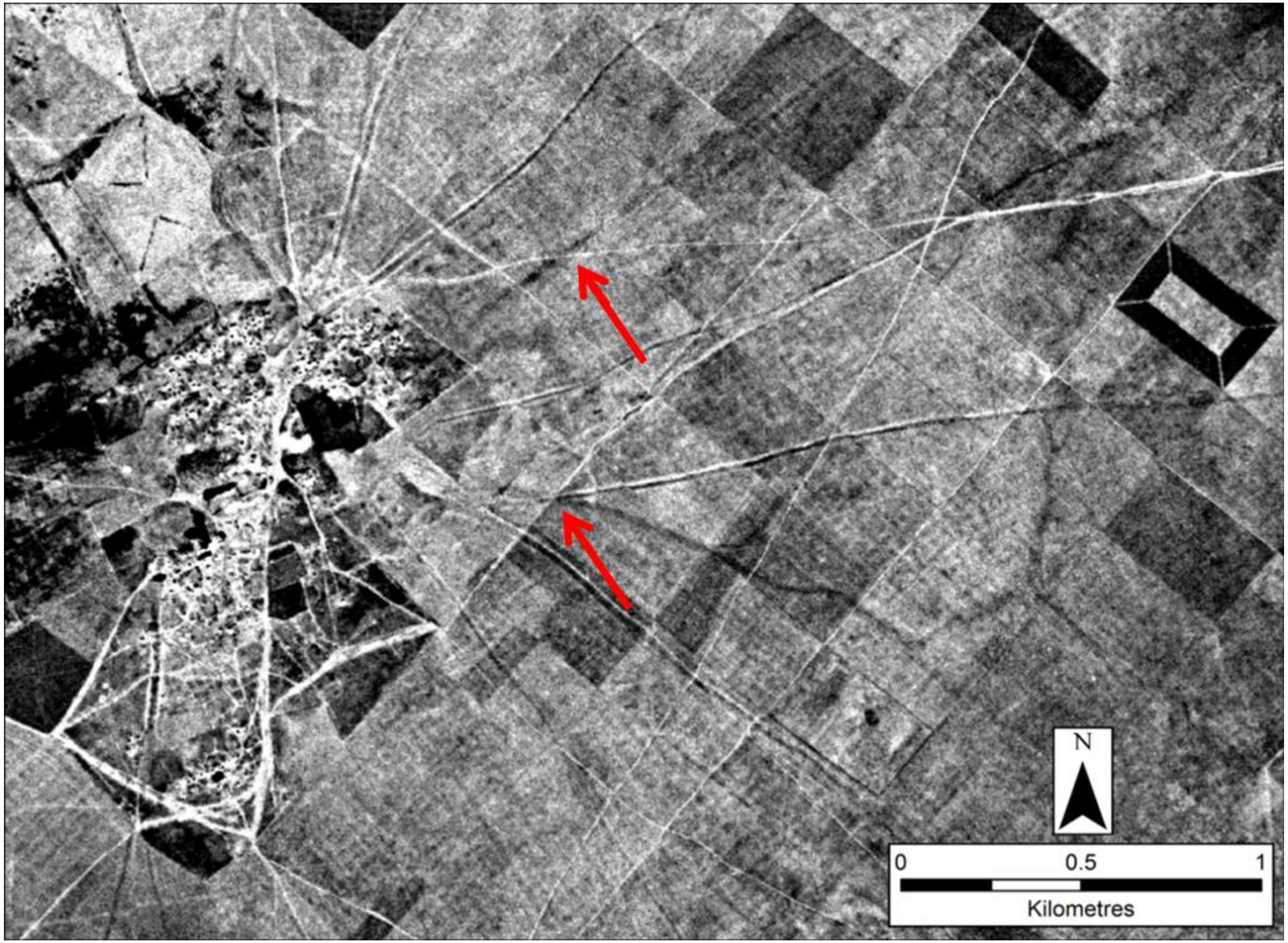


Figure 6-20: Hollow ways extending from GWS_19, GWS_43 and GWS_44. GWS_19 and GWS_43 appear to be connected by a hollow way (HW_18). Phasing of hollow ways is apparent at GWS_19 and at GWS_44. At GWS_44, an earlier set of hollow ways may have radiated out from a no longer extant site or landscape feature to the south of GWS_44.

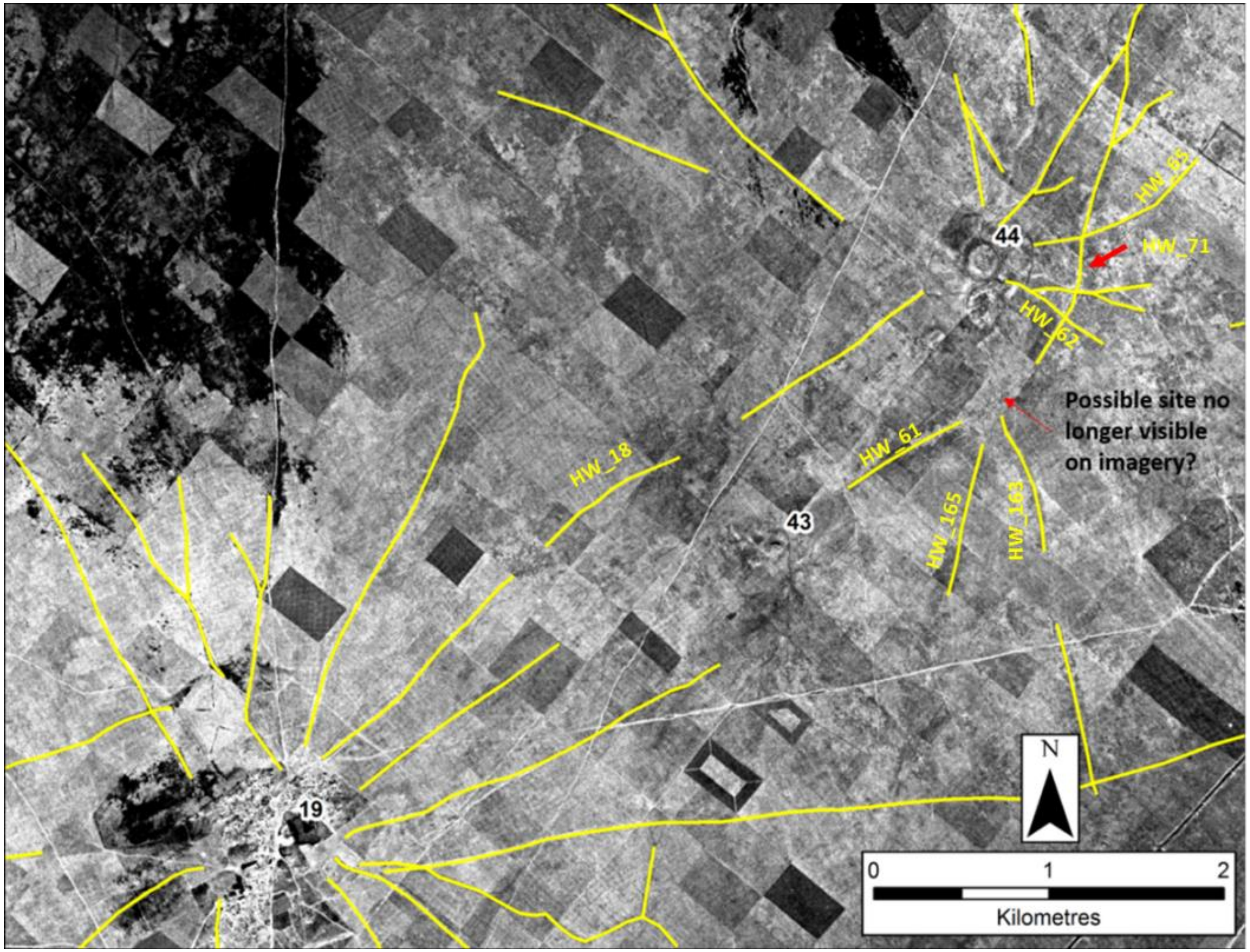
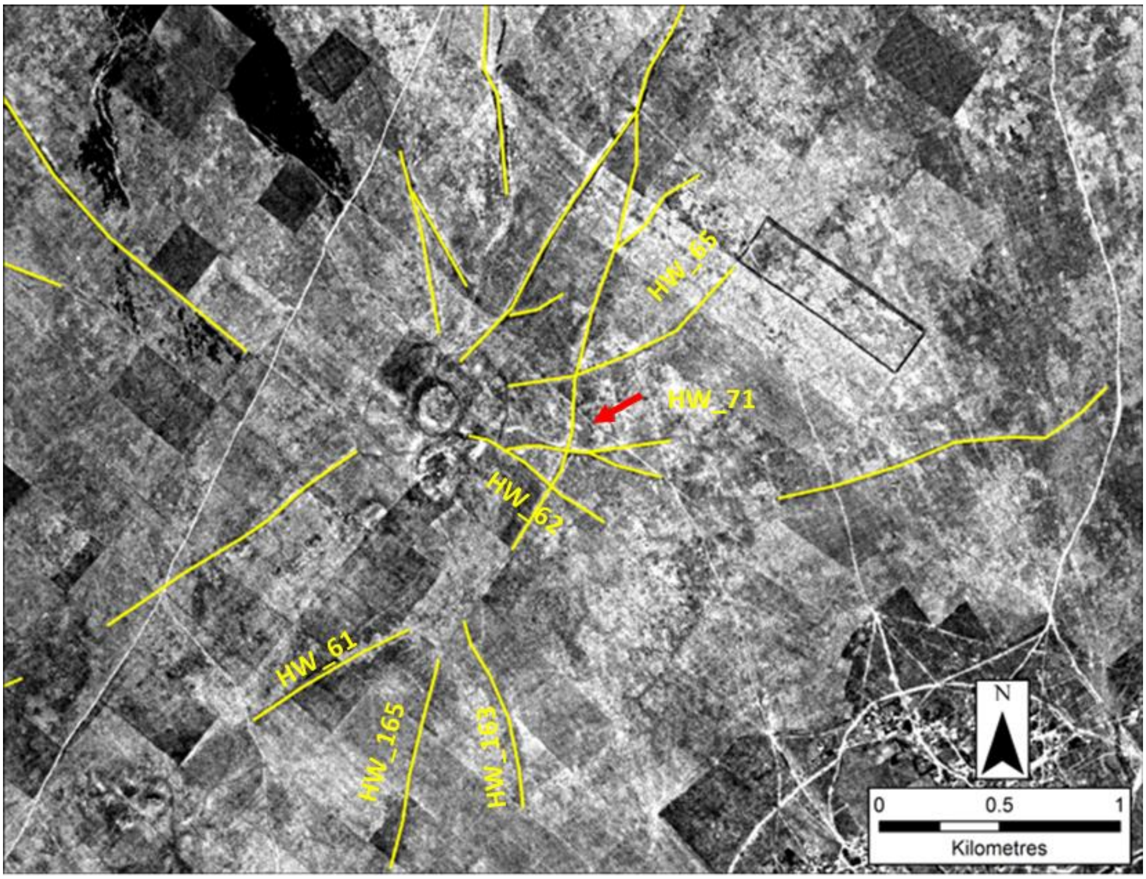


Figure 6-21: Hollow ways extending from GWS_44 with evidence of phasing (indicated by the red arrow).



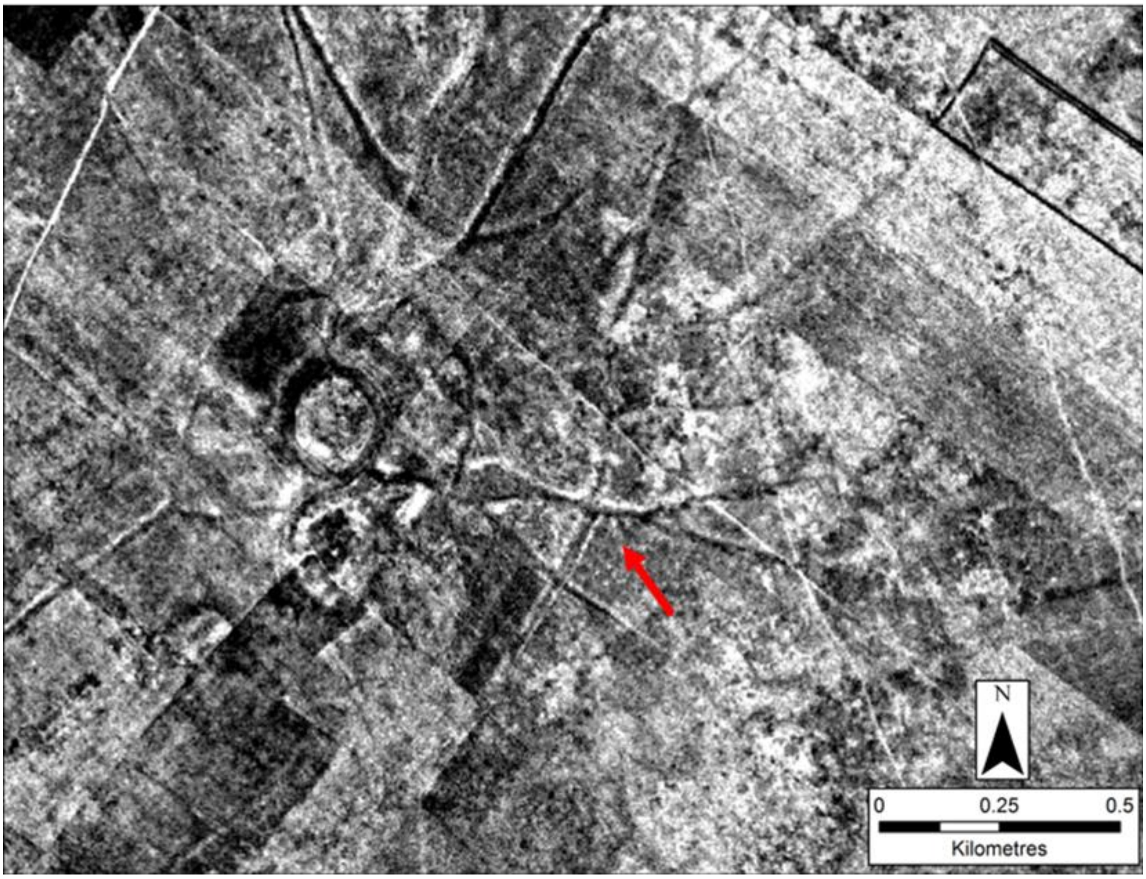


Figure 6-22: A) Hollow ways extending from GWS_18, GWS_20, GWS_21 and GWS_22; B) GWS-20 with clear examples of hollow way phasing (see red arrows).

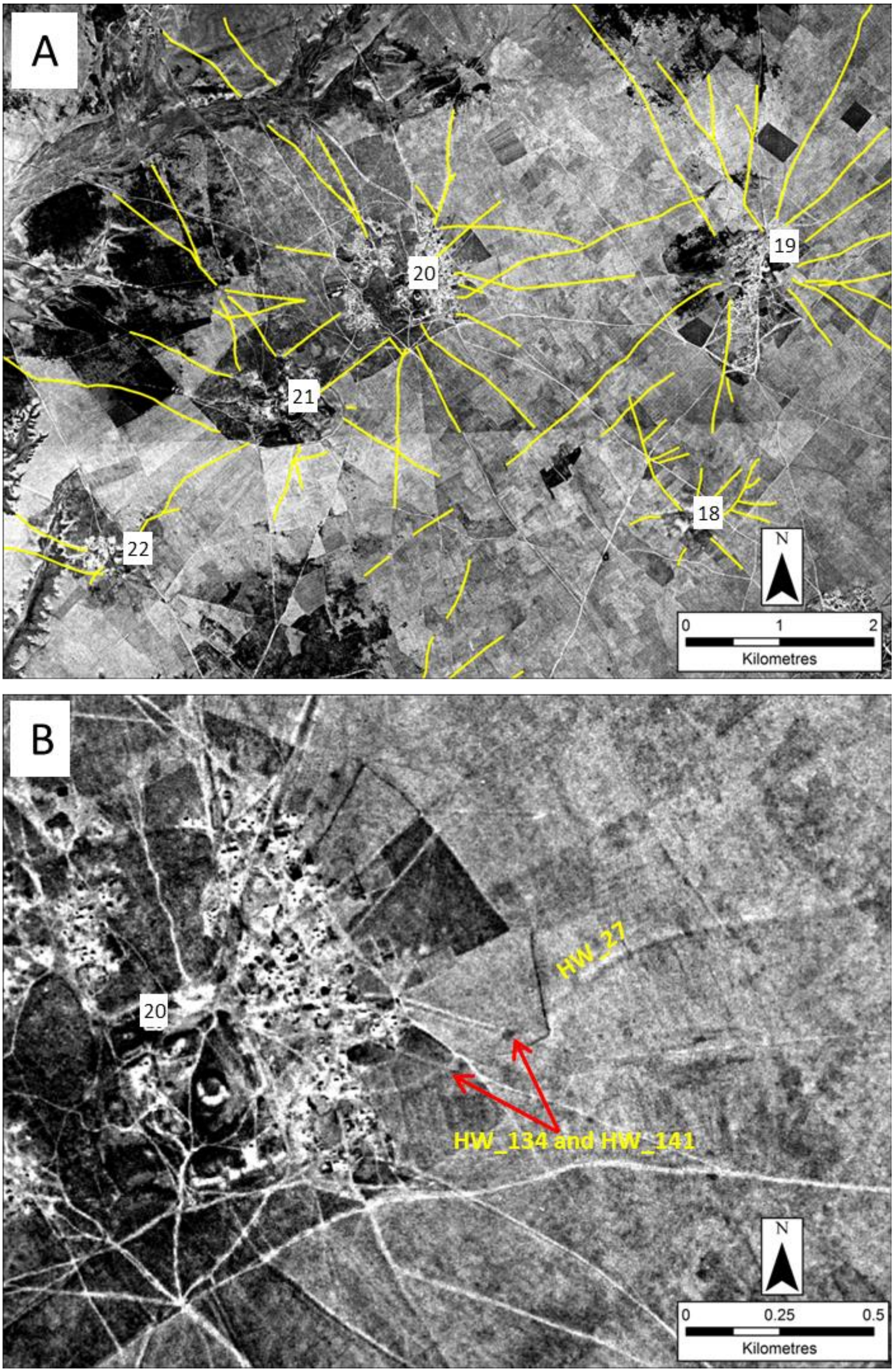
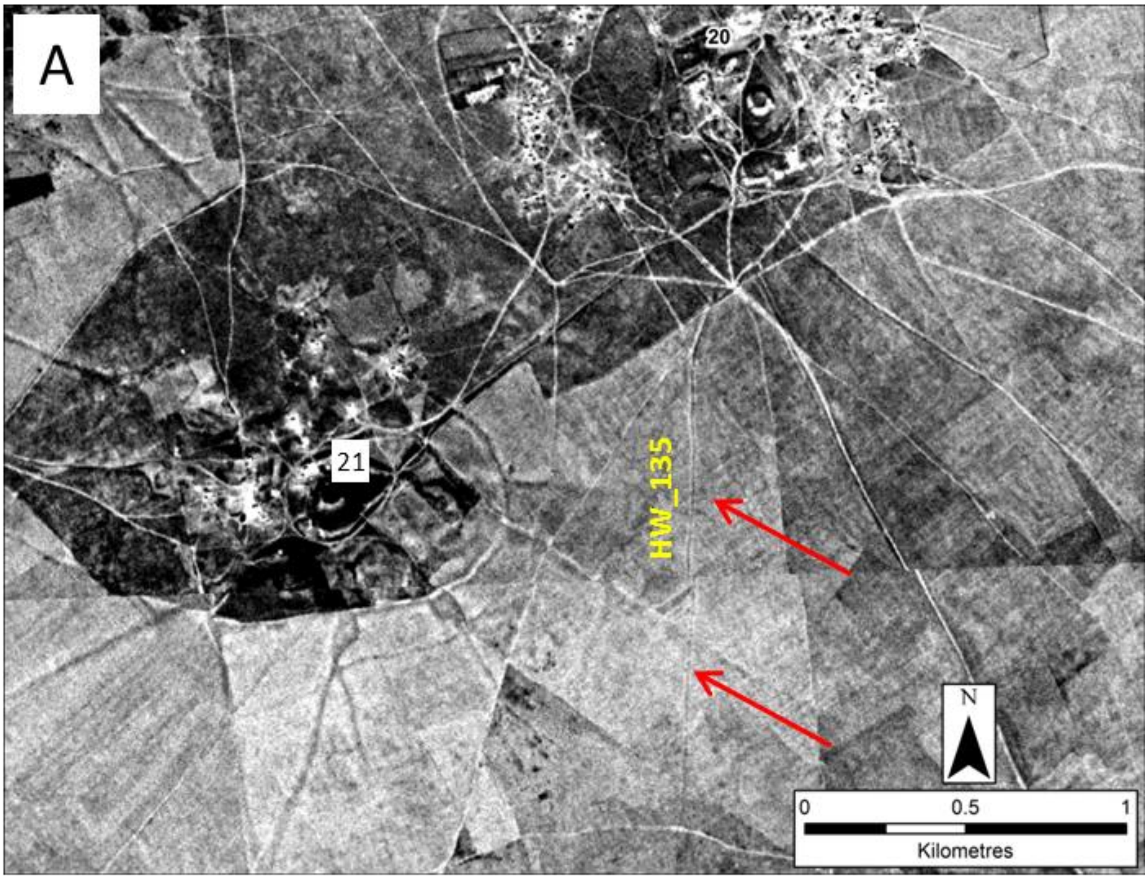


Figure 6-23: A) GWS_21 with evidence of hollow way phasing (see red arrows); B) GWS_22 and GWS_22 connected by a hollow way.



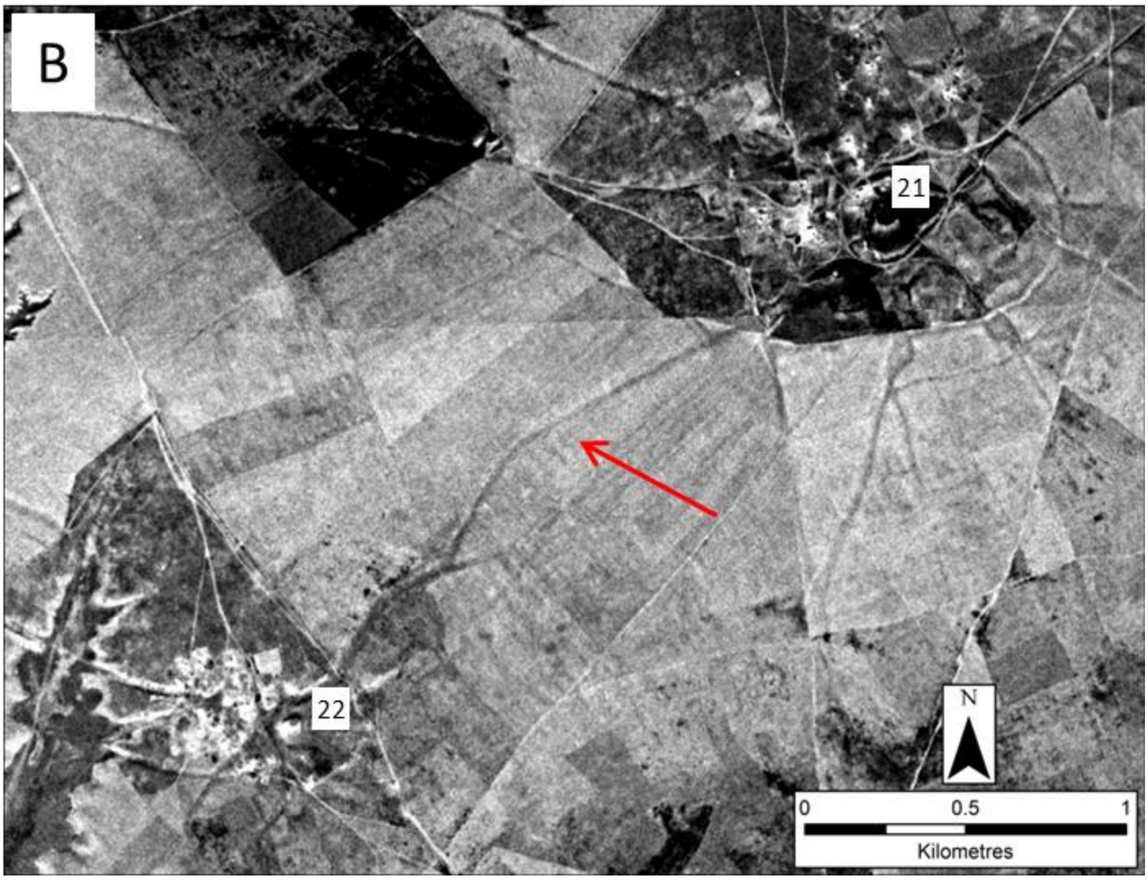


Figure 6-24: Hollow way length and widths around sites in group one in the eastern dry-farming subzone of the plain

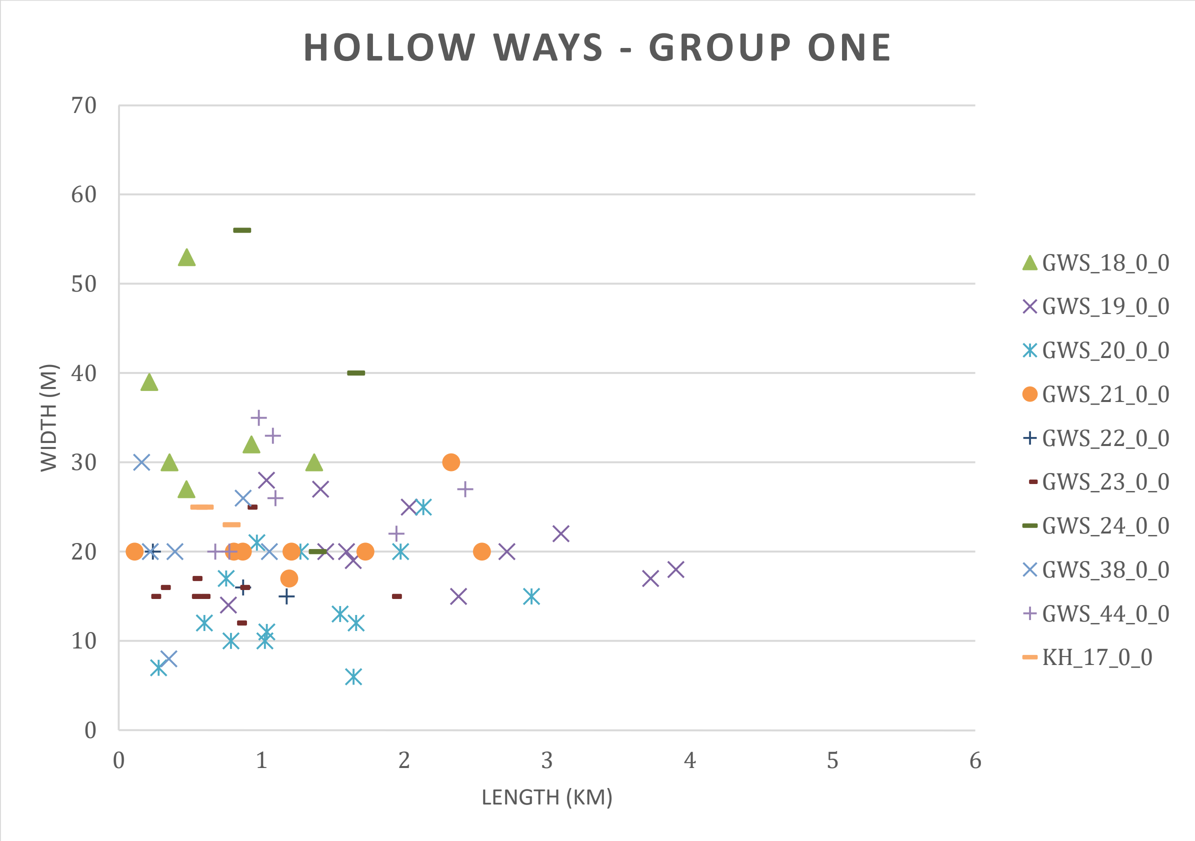


Table 6-14: Site size compared to average length of associated hollow ways

SITE ASSOCIATION	MINIMUM AND MAXIMUM SITE SIZE*	HOLLOW WAYS		
		AVERAGE LENGTH (KM)	MIN LENGTH (KM)	MAX LENGTH (KM)
GWS_18	c. 15	0.5	0.2	1.3
GWS_19	c. 24 (GWS), 57 (CORONA)	1.8	0.3	5
GWS_20	c. 45	1.1	0.01	2.9
GWS_21	c. 72	1	0.1	2.5
GWS_22	c. 10	0.6	0.2	1.2
GWS_23	c. 7 (GWS), 9 (CORONA)	0.7	0.2	1.9
GWS_24	c. 8	1.3	0.9	1.7
GWS_38	c. 19	0.5	0.2	1
GWS_44	c. 1.5 (GWS), 30 (CORONA)	1.1	0.2	2.4
KH_17	c. 3	0.5	0.25	0.6

*(based on field data and corona imagery) (ha) – where substantial discrepancies in site size exist the difference is noted by source.

Figure 6-25: Sites in the eastern dry-farming zone group two. Sites in Bold are visible on the CORONA imagery.

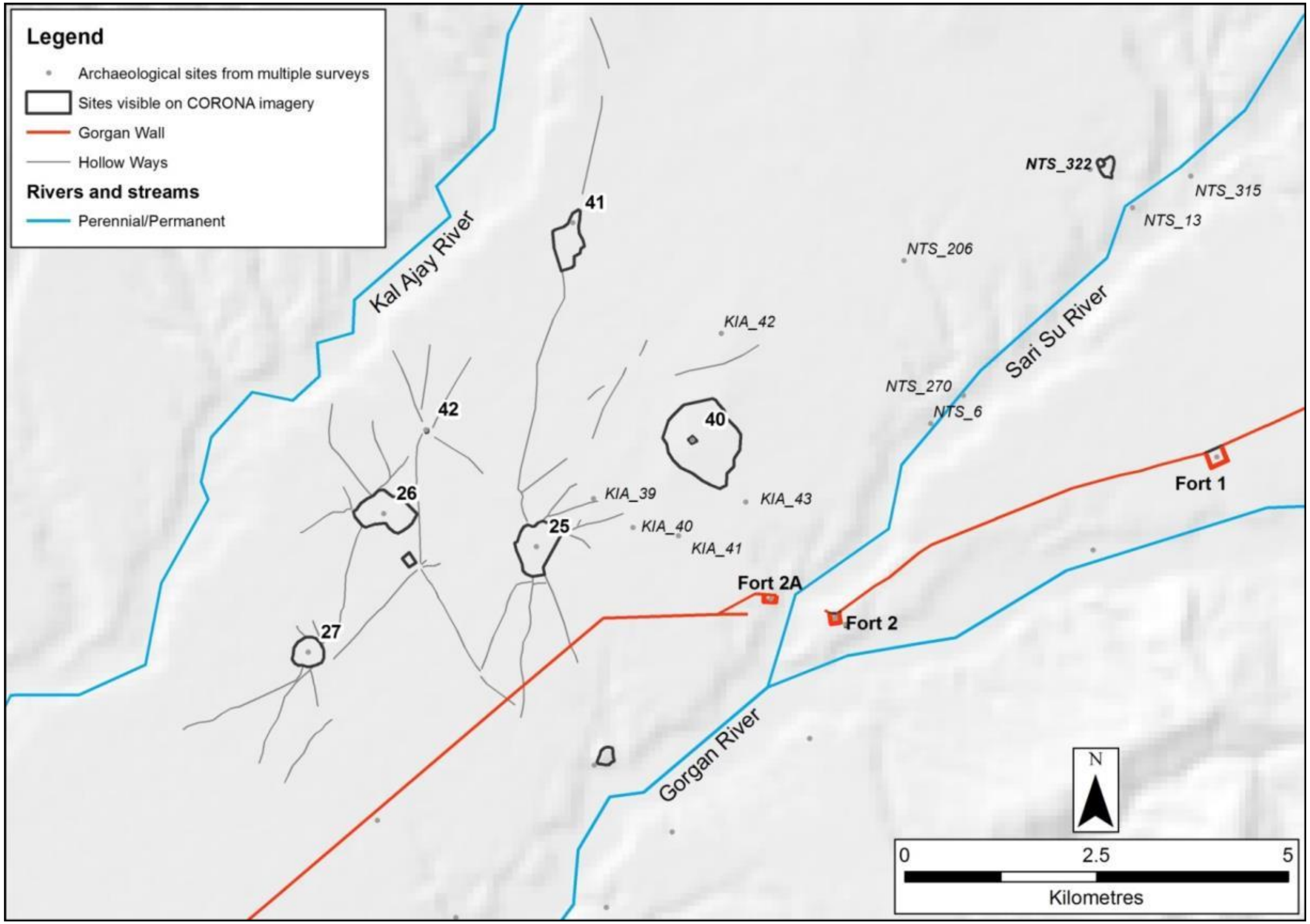


Table 6-15: Dating of sites in the Eastern Dry-farming zone (Group 2) with hollow ways.

DATABASE PARENT_ID	PREHISTORIC	IRON AGE III/IV	ACHAEMENID	PARTHIAN	SASANIAN	ISLAMIC
GWS_25		GWS lab assessment (Iron Age IV) Abbasi 2011		GWS field assessment	GWS lab assessment (Early Sasanian?)	GWS field assessment
GWS_26		GWS lab assessment Abbasi 2011	Abbasi 2011	GWS field assessment Abbasi 2011	GWS field assessment (not echoed in GWS lab assessment)	
GWS_27	Uncertain GWS lab assessment (Early Iron Age?)	GWS lab assessment (Iron Age III; also uncertain Iron Age IV) Abbasi 2011	Abbasi 2011	GWS field assessment Abbasi 2011	GWS field assessment (not echoed in GWS lab assessment)	
GWS_40	Abbasi 2011 (Early Bronze Age)				GWS field assessment (based on presence of Gorgan Wall brick only) - uncertain	
GWS_41		Abbasi 2011				
GWS_42		GWS field assessment	Abbasi 2011	Abbasi 2011		

Figure 6-26: A) GWS_25, B) GWS_26, C) GWS_27, D) GWS_40, E) GWS_41, F) GWS_42 on the CORONA imagery (imagery available from the US Geological Survey).

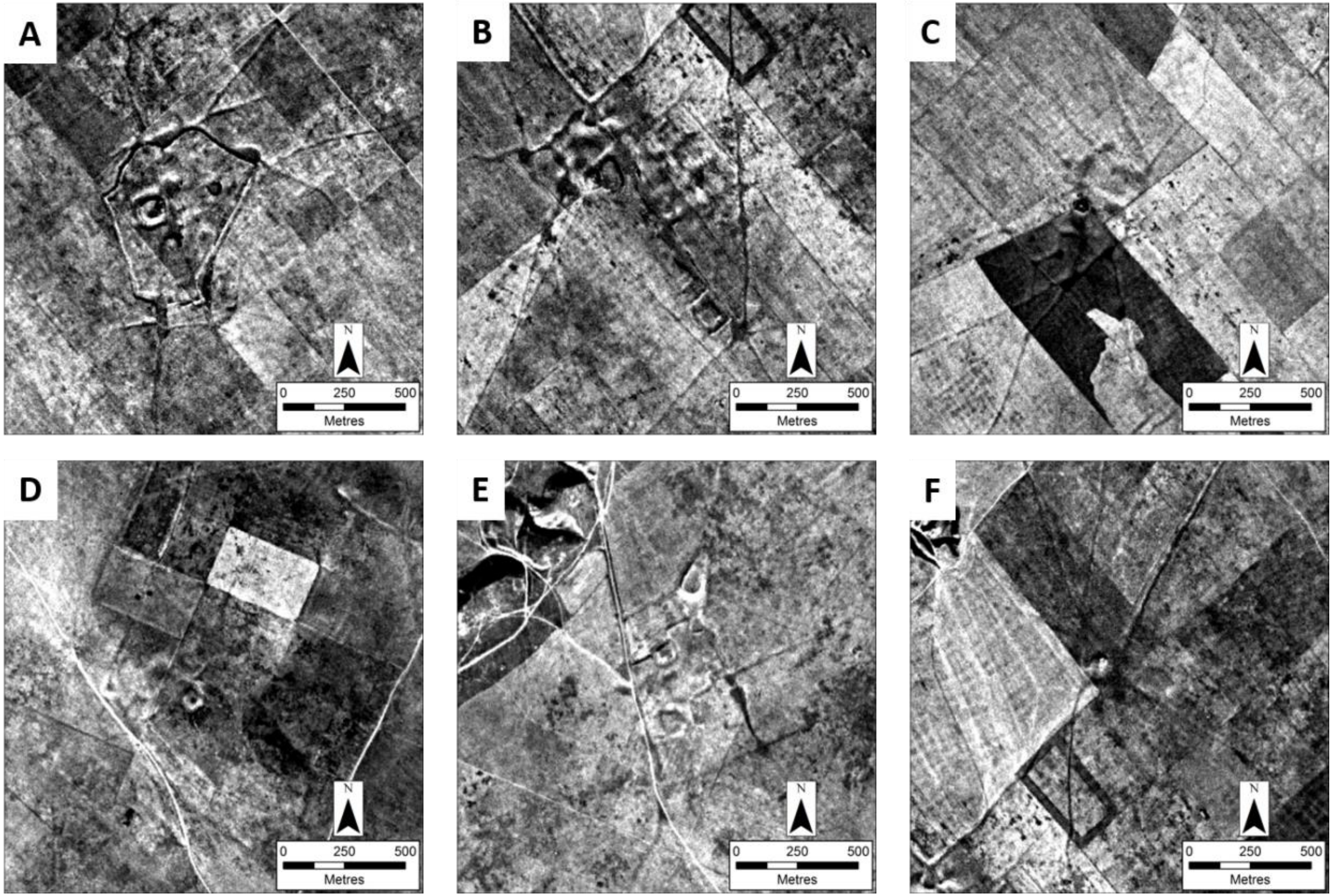


Figure 6-27: Hollow way length and widths around sites in group two in the eastern dry-farming subzone of the plain.

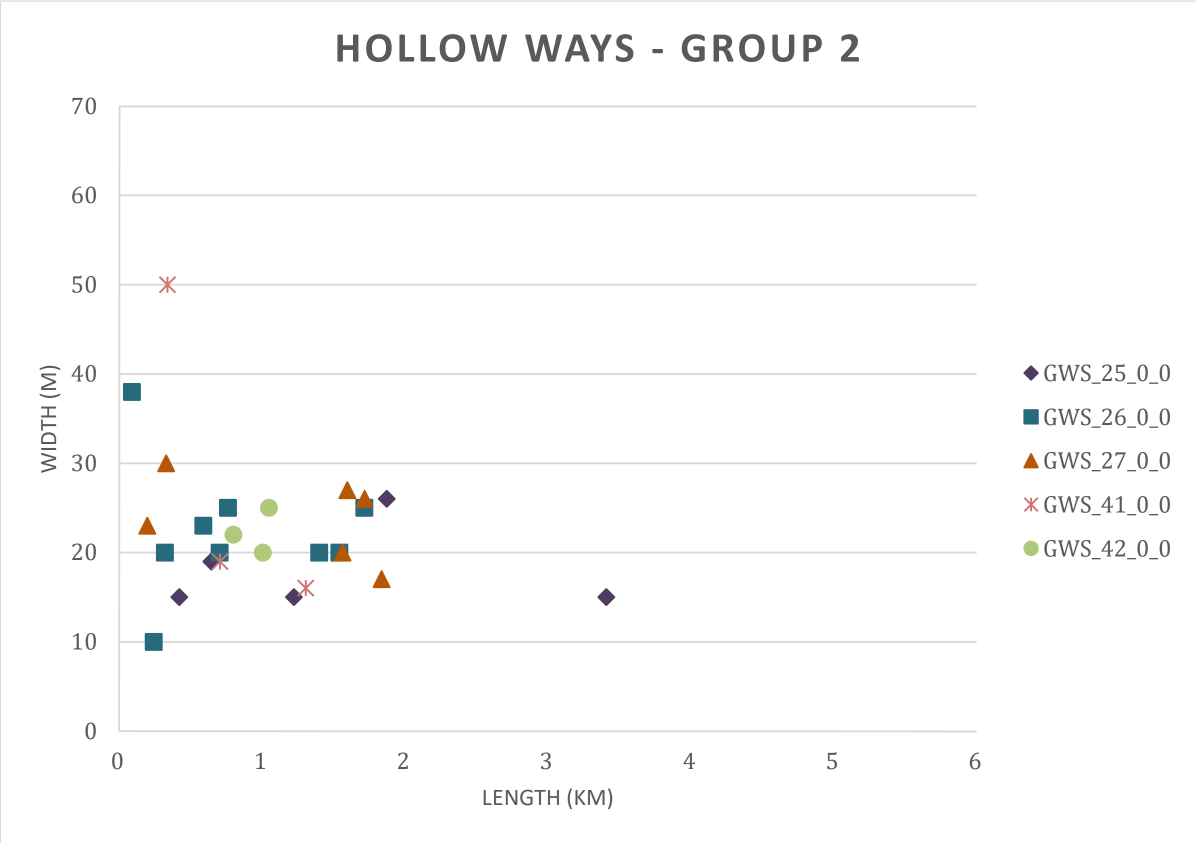


Figure 6-28: A) GWS-55 on CORONA Imagery (CORONA imagery available from the US Geological Survey). B) GWS-55 on an aerial photo taken in 1937 (Schmidt 1940: Plate 68 - Courtesy of the Oriental Institute of the University of Chicago).

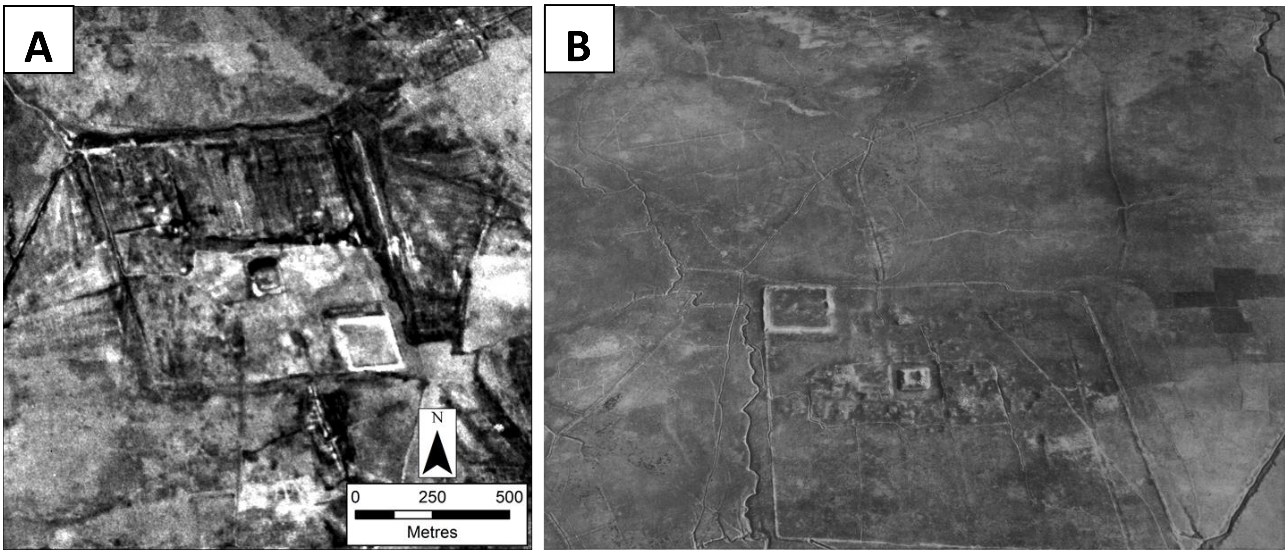


Figure 6-29: Aerial photograph of Tureng Tappeh illustrating the main tappeh and other mounding in the vicinity (Schmidt 1940: Plate 71).

Image redacted due to copyright

Figure 6-30: Sites with Iron IV occupation south of the Gorgan River. A) GWS-31, B) GWS-32, C) GWS-33, D) GWS-34.

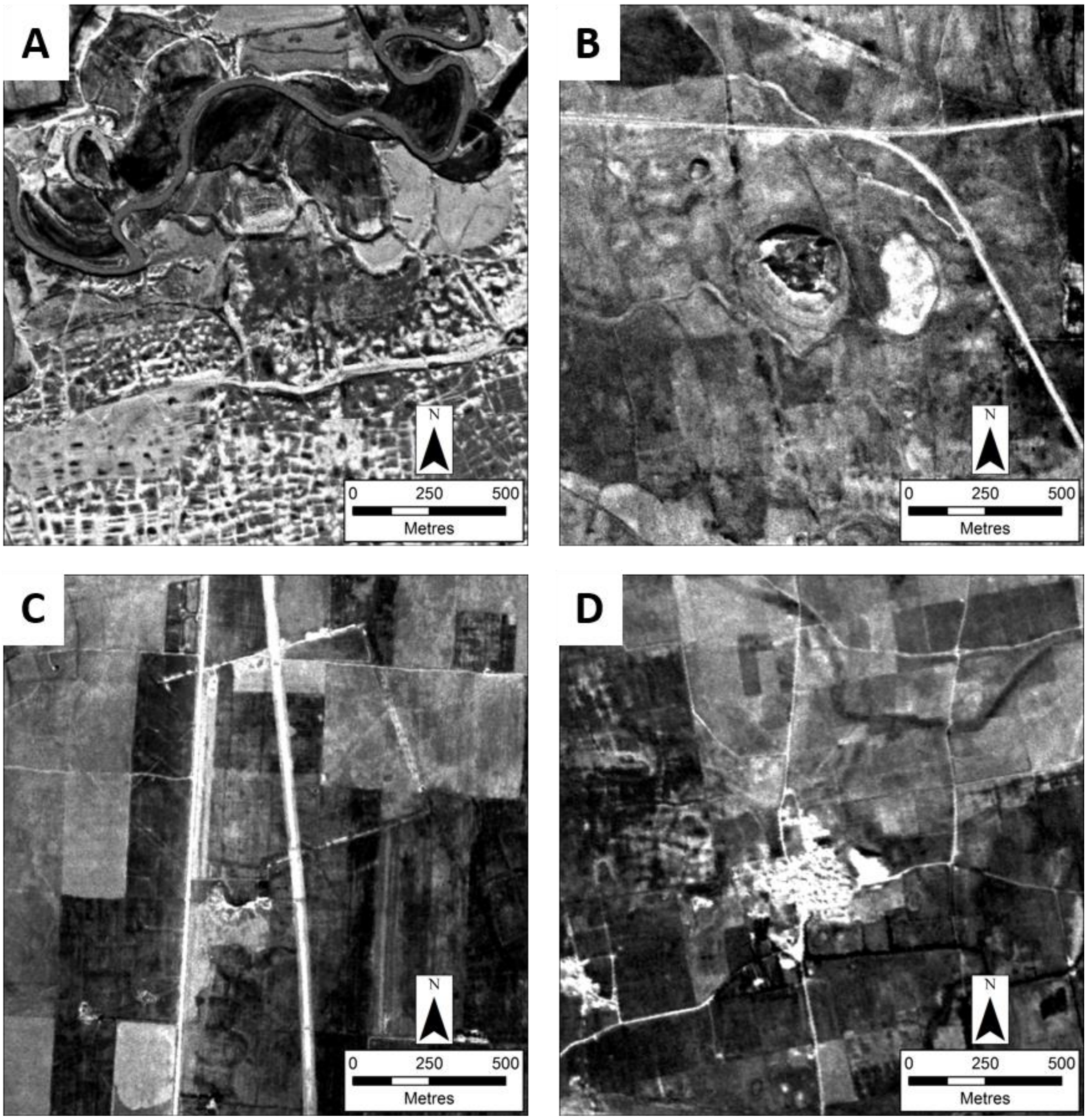


Figure 6-31: Location of sites dated to the Iron Age III, IV, Achaemenid or Parthian period from all datasets (Abbasi 2011; Kiani 1982b; Wilkinson et al. 2013). Basemap SRTM 90m hillshade (Data available from the US Geological Survey).

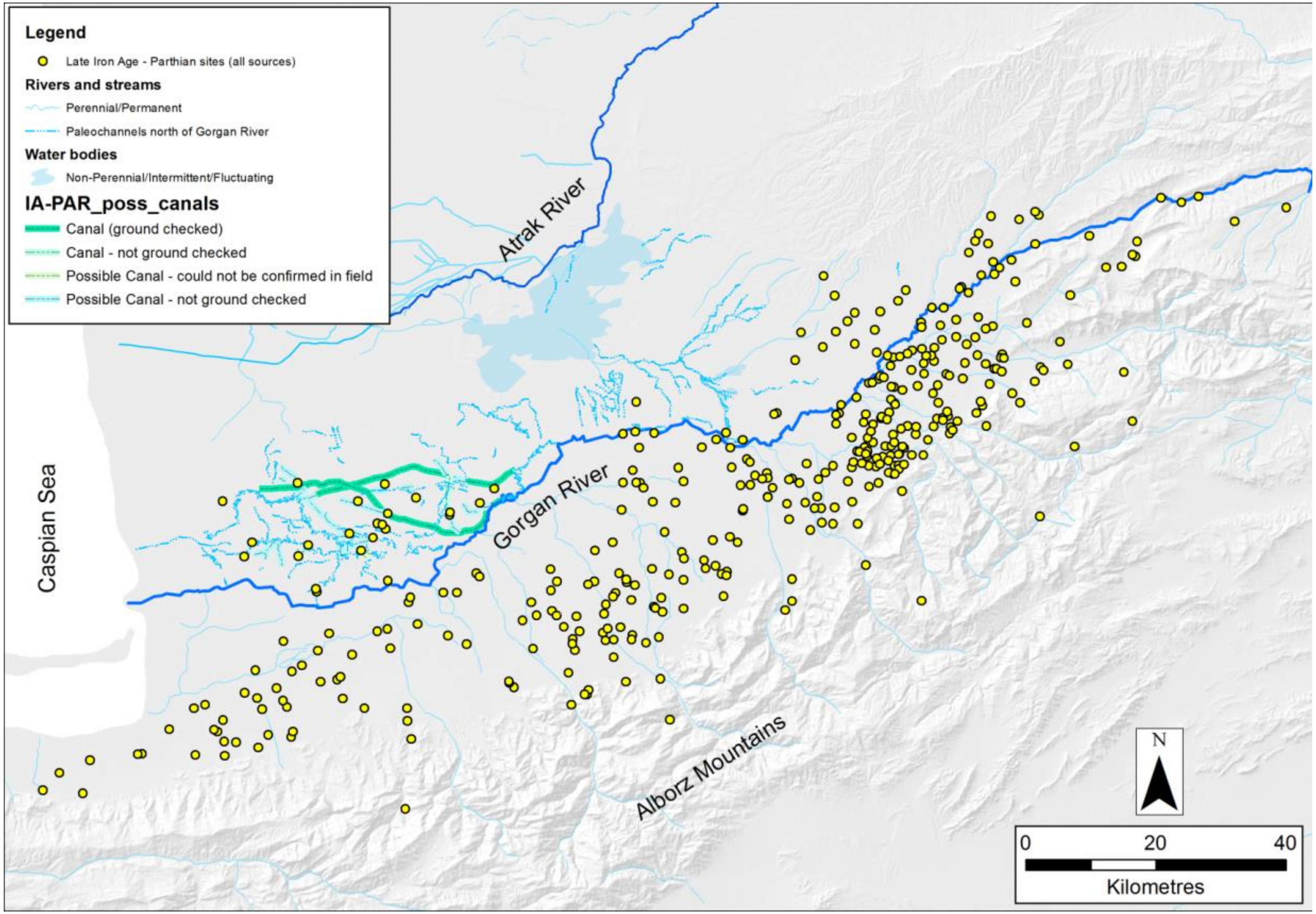


Figure 6-32: (Top) Geophysical survey of Qelich Qoineq superimposed over a digital elevation model of the site (30m resolution); note the difference between the visible extent of the mounds and the features likely representing architectural features indicated on the geophysical plot; (Bottom) the same area on the CORONA imagery (imagery available from the US Geological Survey).

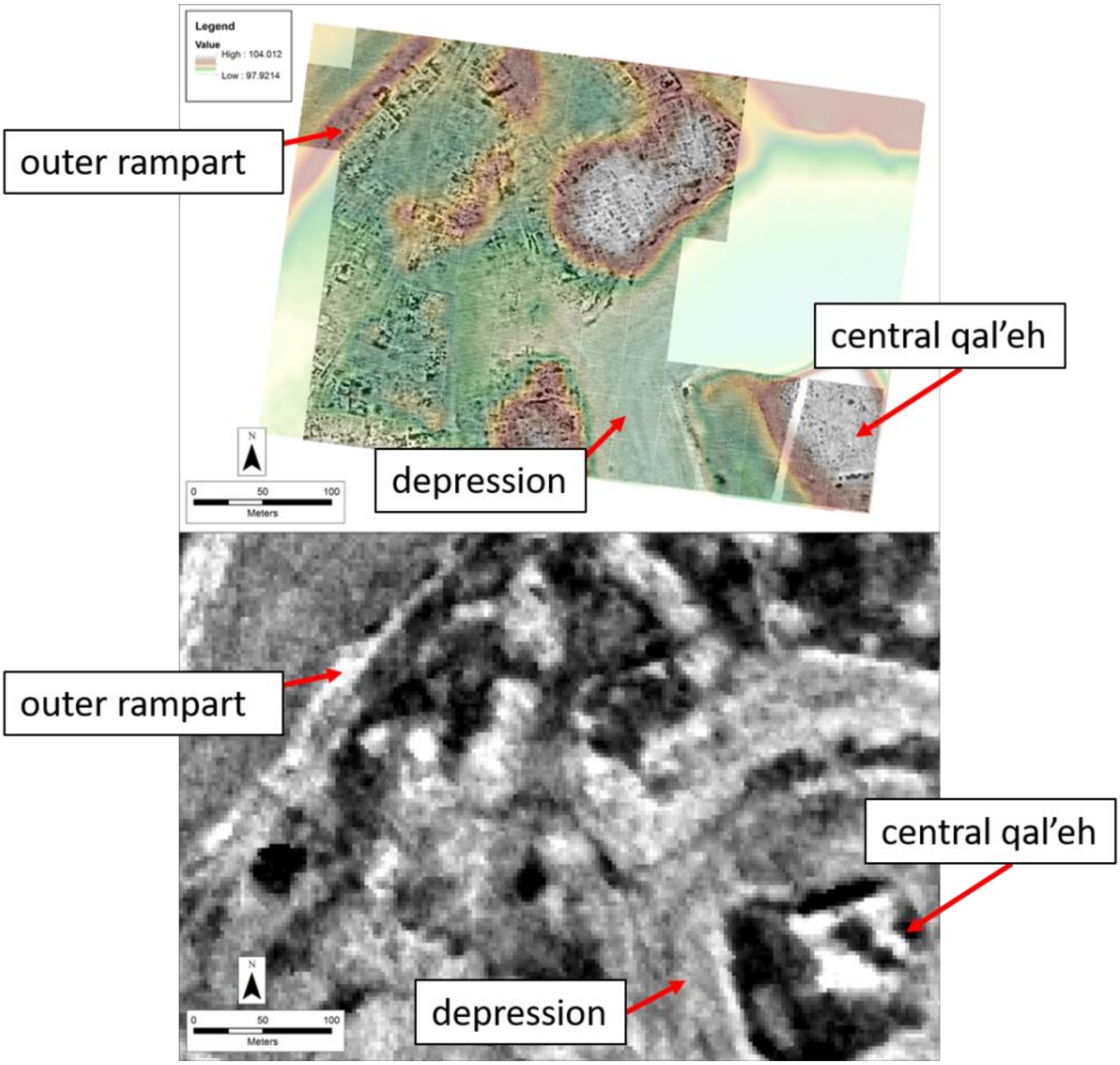


Figure 6-33: Extent of the outer mounds mapped by GPS in the field at Qelich Qoineq.

Figure 6-34: The site of Qelich Qoineq viewed on imagery available on Google Earth – Date of imagery 24 Feb 2014.

Figure 6-35: Area covered by mounding in field compared to the area of visible architectural features recorded in the geophysical plot at Qelich Qoineq.

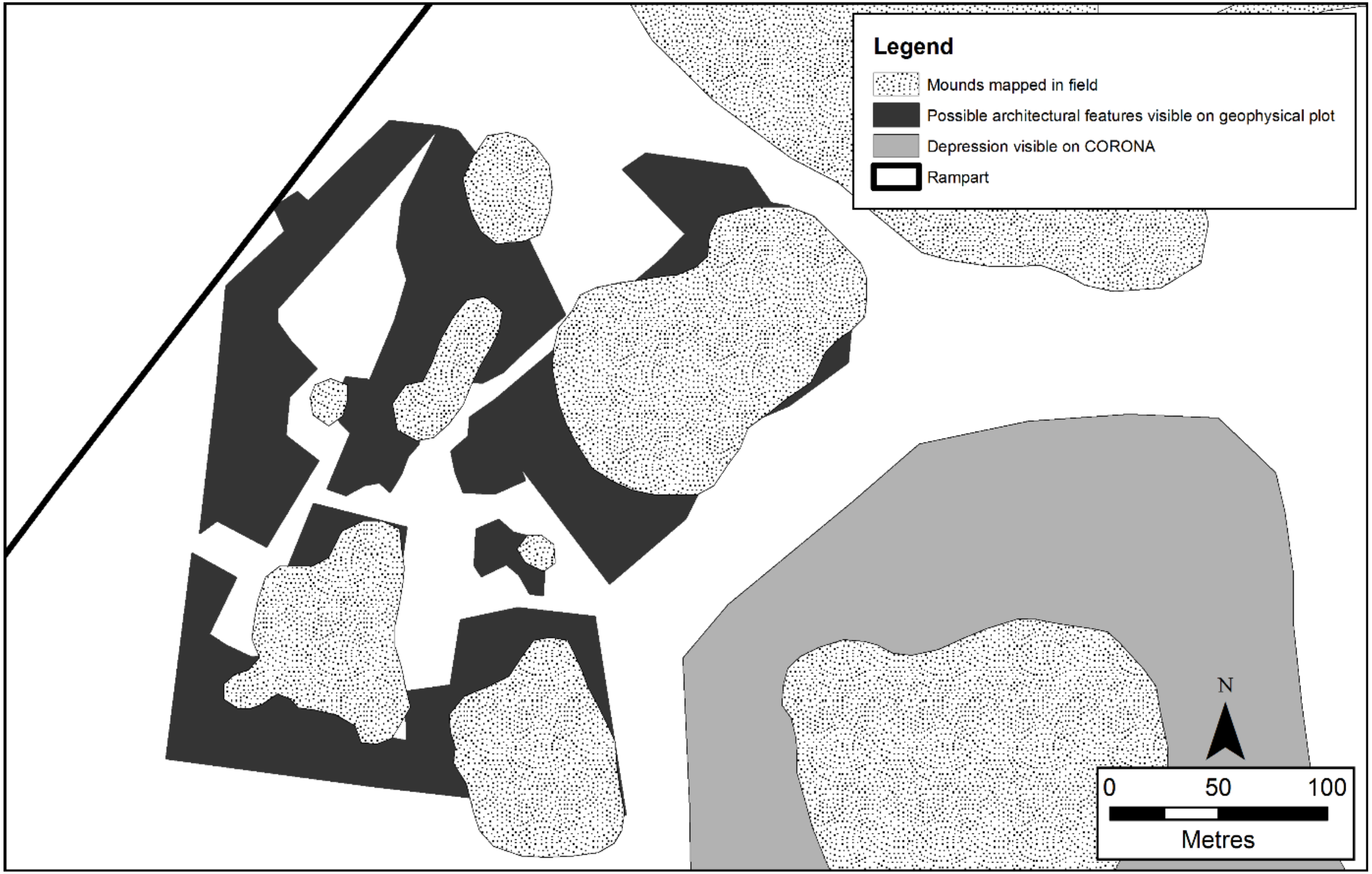


Table 6-16: Radiocarbon Dates from Trench P (After Sauer et al. 2013: Table 14:1)

CONTEXT	SAMPLE NO.	DATE	CALIBRATED DATE (95.4% CONFIDENCE)
P.004	OxA-20171	2469 ± 26 BP	761–416 BC
P.013	OxA-20172	2463 ± 26 BP	756–415 BC
P.024	OxA-20086	2521 ± 26 BP	791–543 BC

Figure 6-36: Radiocarbon dates from Trench P at Qelich Qoineq (After Sauer et al. 2013: Fig. 14:10).

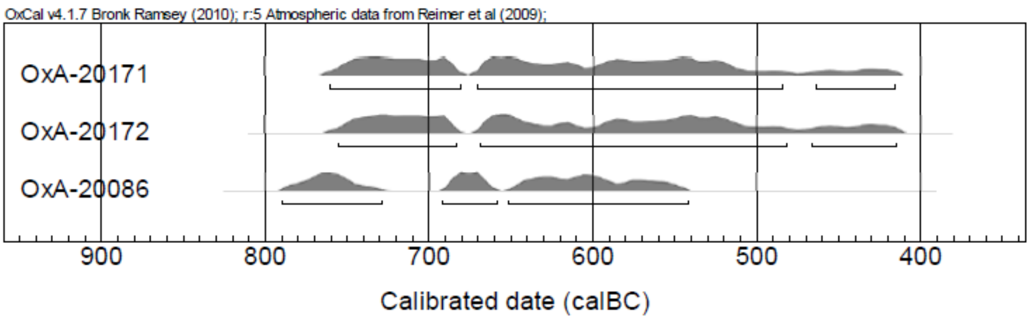


Figure 6-37: Possible hollow ways in the western steppe. Radial hollow way-like features, similar to those found in the eastern dry-farming zone, are found extending from GWS-15

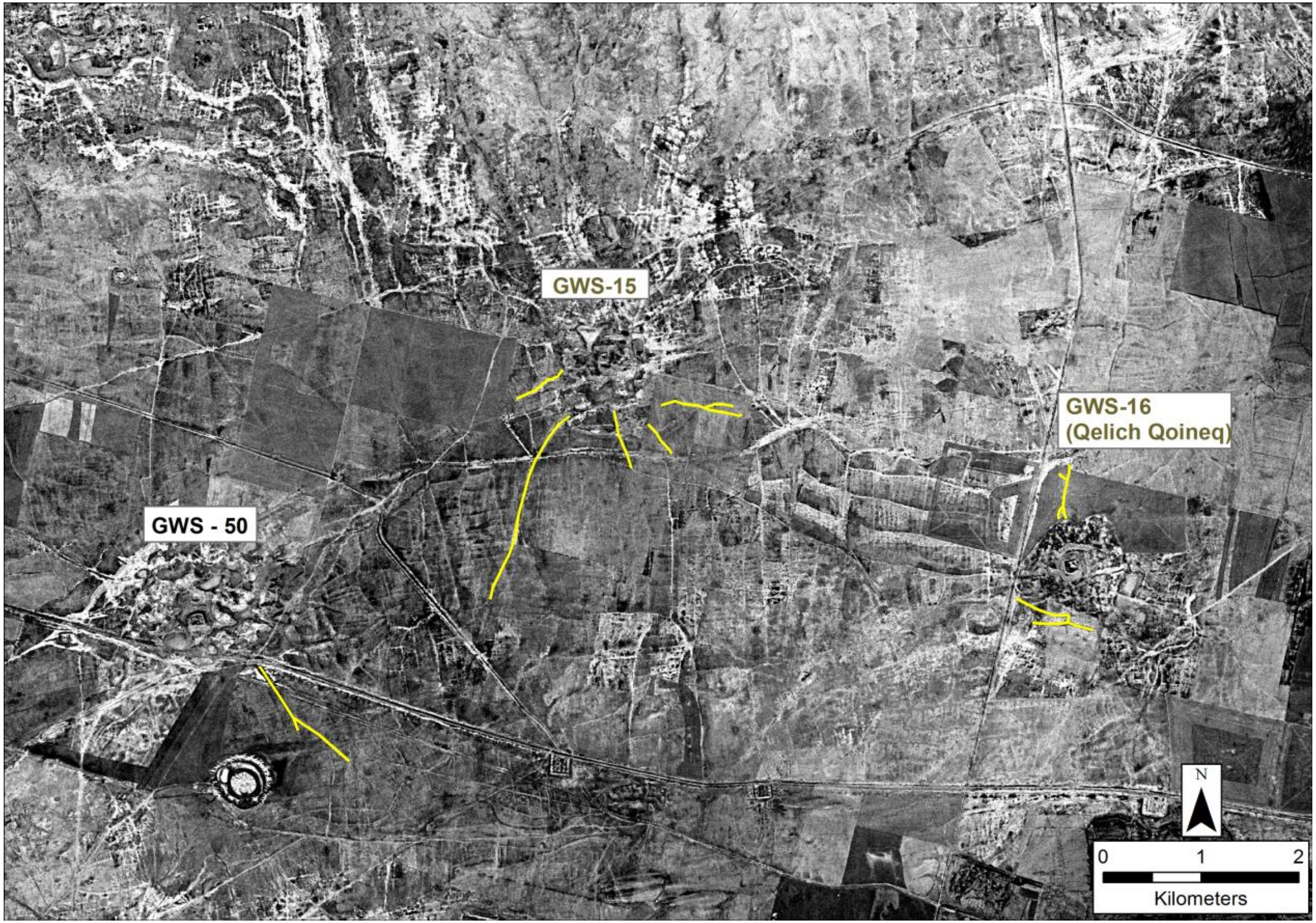
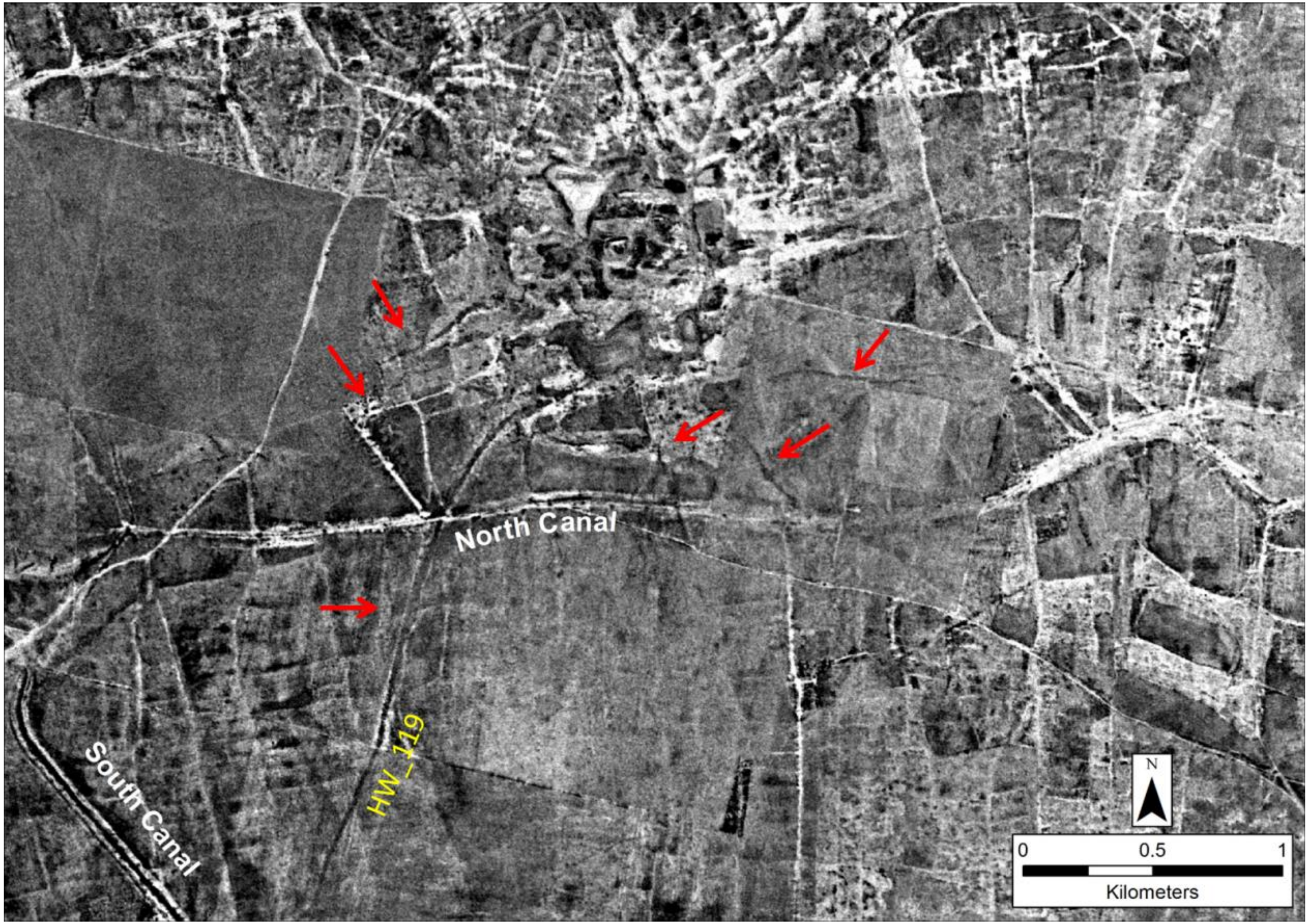


Figure 6-38: Likely hollow ways extending out from GWS_15.



7. LANDSCAPES OF THE SASANIAN PERIOD ON THE GORGAN PLAIN

Figure 7-1: Sites occupied in the Sasanian period (Abbasi 2011, Boucharlet and Lecomte 1987, Kiani 1982b, Wilkinson et al. 2013) assessed by certainty. Sites indicate in purple have no dating evidence, but share strong morphological similarities to known Sasanian sites.

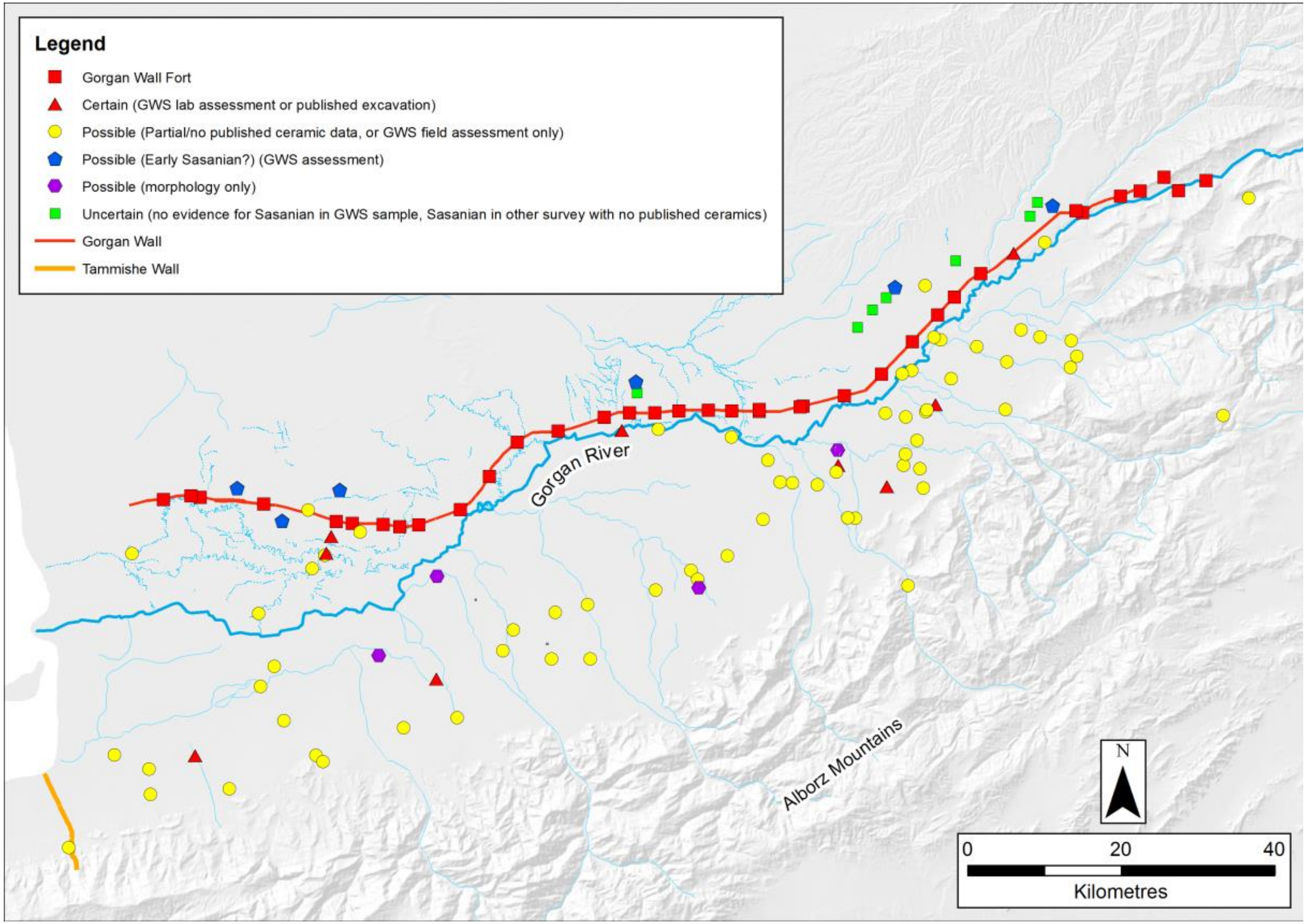


Figure 7-2: A) GWS_1, B) GWS_33, C) GWS_37, D) GWS_53, E) GWS_49, F) GWS_35. CORONA imagery (imagery available from the US Geological Survey).

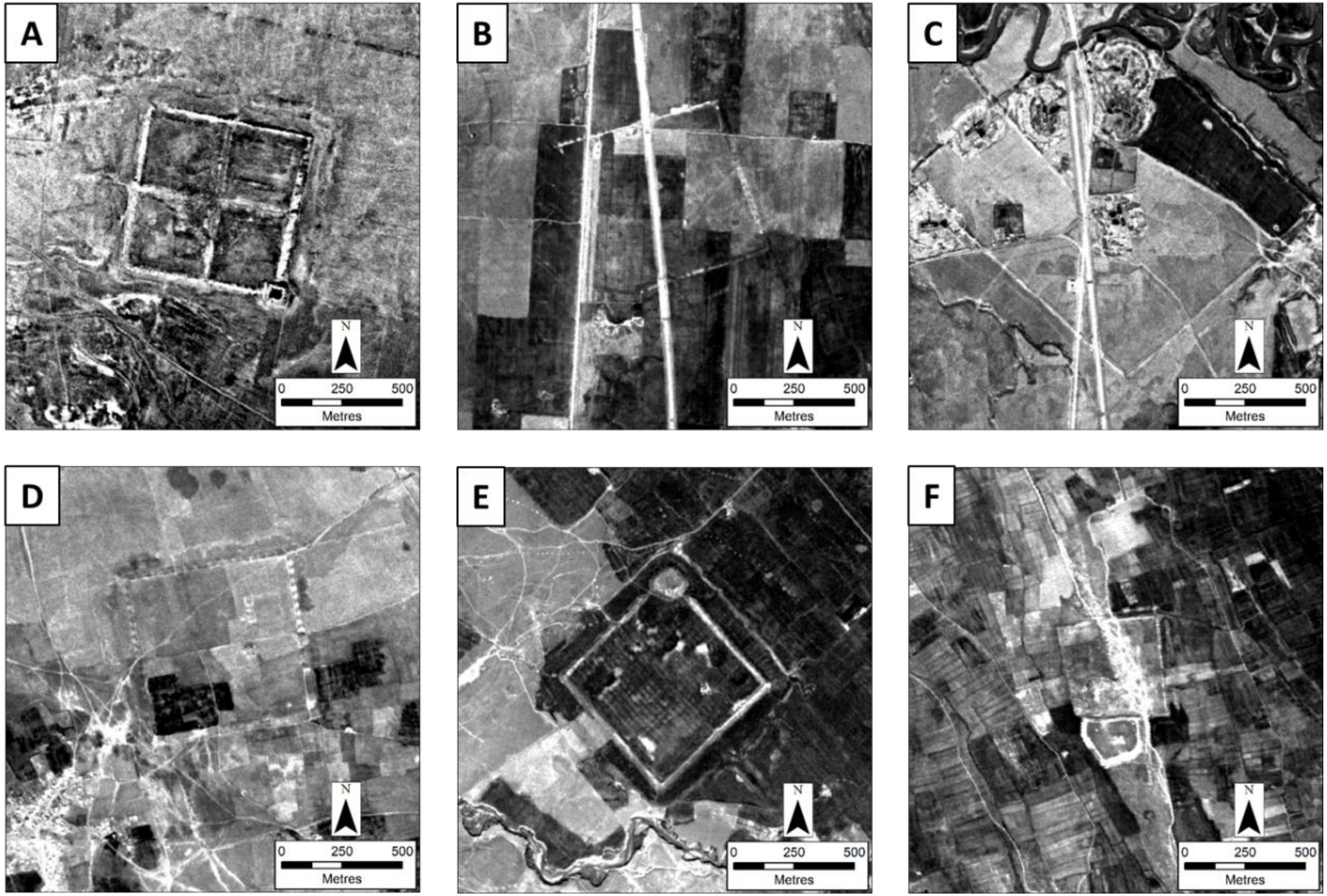


Figure 7-3: Small qal'eh sites with Sasanian or possible Sasanian occupation – (L) GWS_2 and GWS_13, (Centre) Tureng Tappeh and (R) GWS_56.

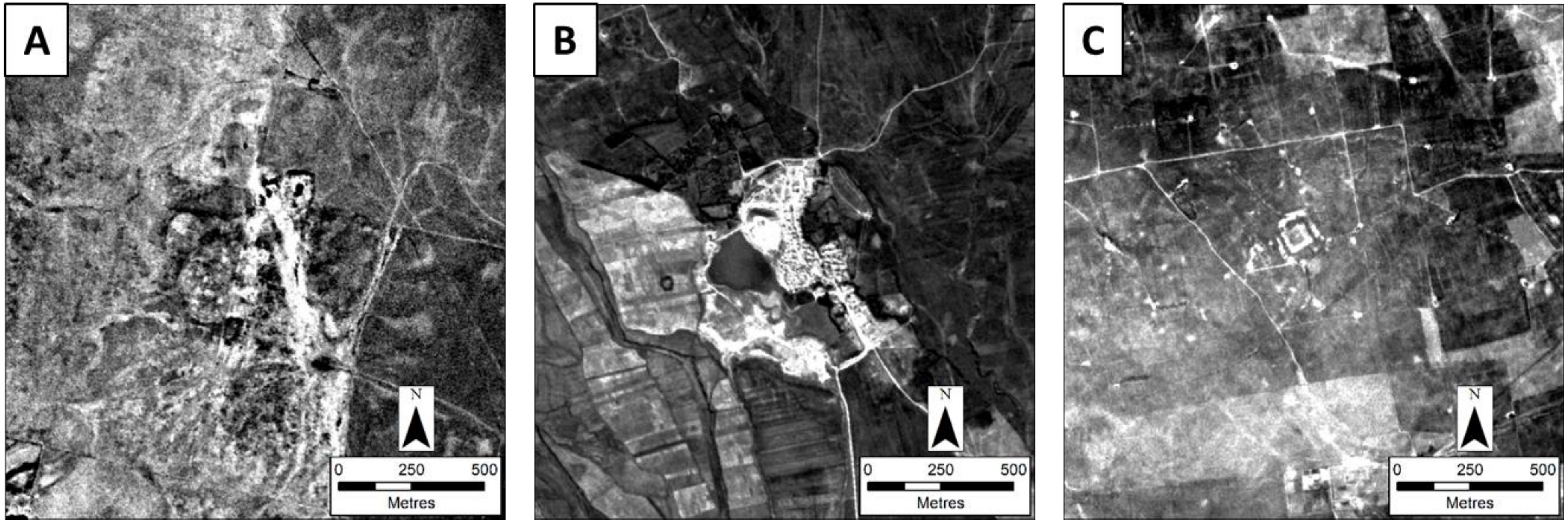


Table 7-1: Rectilinear enclosures from observations on morphology in the database. Coordinates are in UTM 40 N.

PARENT_ID	MORPHOLOGY	SITE SIZE (CORONA)	DATING INFORMATION (SOURCE)	COMMENTS	EASTING	NORTHING
KH_51	Rectilinear enclosure (square)	c. < 1 ha	No dating info	CORONA only	324543	4140710
KH_63, KH_64, KH_65	Three rectilinear qal'ehs or enclosures	c. < 1 ha	No dating info	Each enclosure no more than 1 ha (c. 0.3 to 0.8 ha)	317590 317746 317877	4152516 4152454 4152362
KH_74	Rectilinear enclosure	c. < 1 ha	No dating info		313747	4107596
KIA_7	Rectilinear enclosure	c. < 1 ha	No dating info	Only partial enclosure - no evidence on east side. Immediately south of South Canal.	279949	4108732
KH_11	Rectilinear enclosure (square)	c. 1 ha	No dating info	Located immediately south of the Gorgan Wall.	296251	4121983
KH_93	Rectilinear enclosure	c. 1 ha	No dating info	CORONA only	309868	4109944
KIA_13	Rectilinear enclosure (square)	c. 1 ha	No dating info	Part of a larger site complex	291683	4122092
KIA_28	Rectilinear enclosure (square)	c. 1 ha	No dating info	Very small mound in the centre of enclosure. C. 400m to SE of Fort 17	316928	4125229
KH_196	Rectilinear enclosure	c. 2 ha	No dating info		349933	4127646

PARENT_ID	MORPHOLOGY	SITE SIZE (CORONA)	DATING INFORMATION (SOURCE)	COMMENTS	EASTING	NORTHING
KH_12	Rectilinear enclosure or mound with rectilinear qal'eh	c. 3 ha	Islamic (Abbasi 2011)		292132	4112949
TJW_3	Rectilinear enclosure or tappeh (square)	c. 5 ha	No dating info		328452	4125073
KH_39	Main tappeh surrounded by complex of low mounds. Possible rectilinear enclosure to the south of the mound grouping?	c. 15 ha	Tappeh complex dated to the Chalcolithic, Bronze Age, Iron Age III/IV, Parthian, Islamic (Abbasi 2011)	Entire site (including associated mounds and possible enclosure) is c. 26 ha. This enclosure part of the site has been assessed with low/medium archaeological significance.	349421	4119326
KH_84	Rectilinear enclosure (rectangular)	c. 77 ha	No dating info	Crenulations around the exterior of the enclosure may represent projecting towers as suggested for Qal'eh Daland (GWS_53). Further investigation would be required to date the enclosure with confidence.	319225	4102612

Figure 7-4: A) Large rectilinear enclosure located on the CORONA imagery A) KH_84, B) Qal'eh Daland (GWS_53).

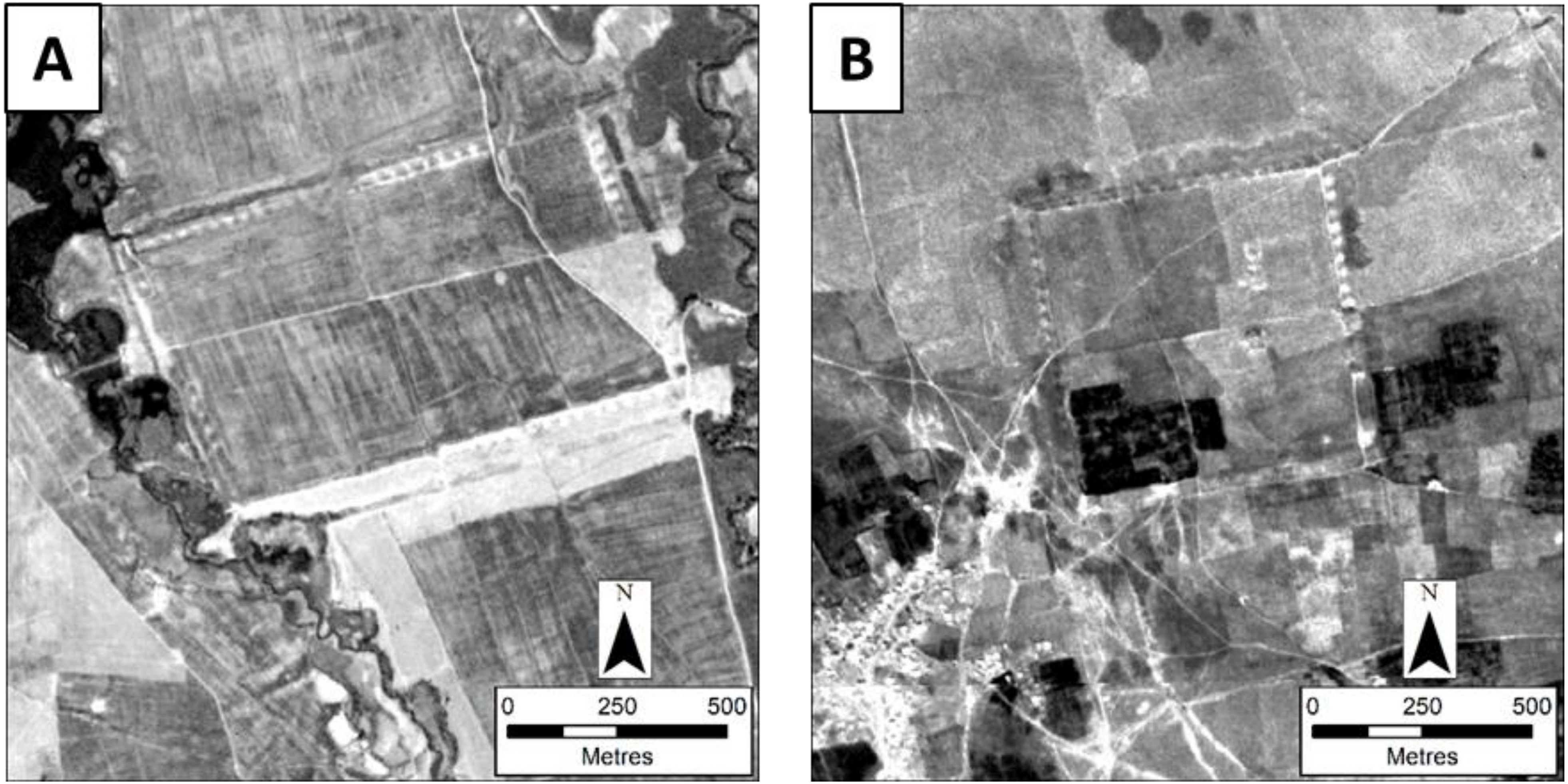


Figure 7-5: Rectilinear enclosures of 2-6 ha. A) Fort 14 and Fort 14N (FORT_17 and FORT_18), B) TJW_3, C) KH_196, D) KH_12, E) KH_5, F) GWS_57 (Qal'eh-ye Hajilar).

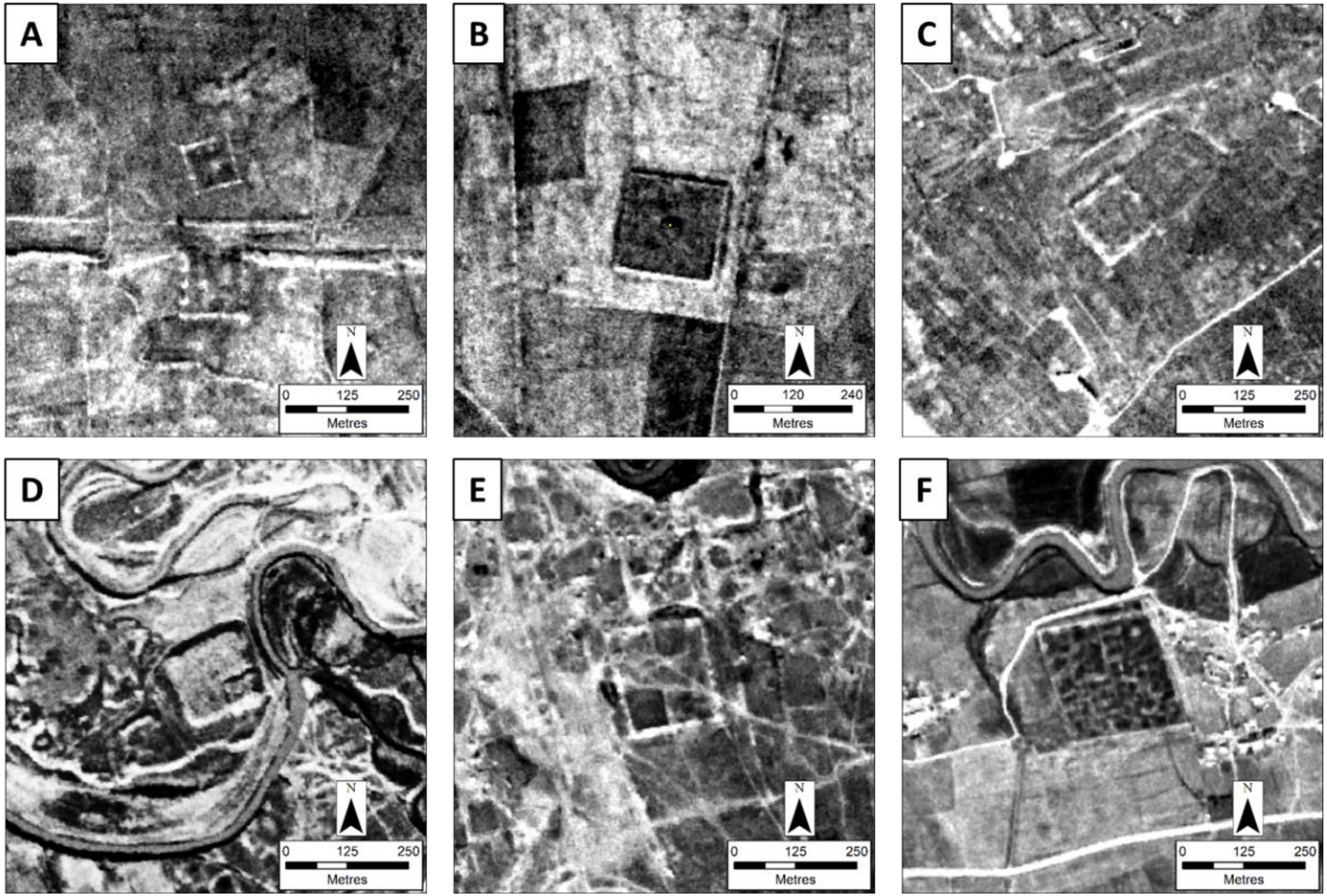


Figure 7-6: Rectilinear Enclosures of 1 ha or less. A) KH_51, B) KH_63, C) KH_74, D) KIA_13, E) KIA_7, F) KH_11, G) KH_93, H) KIA_28.

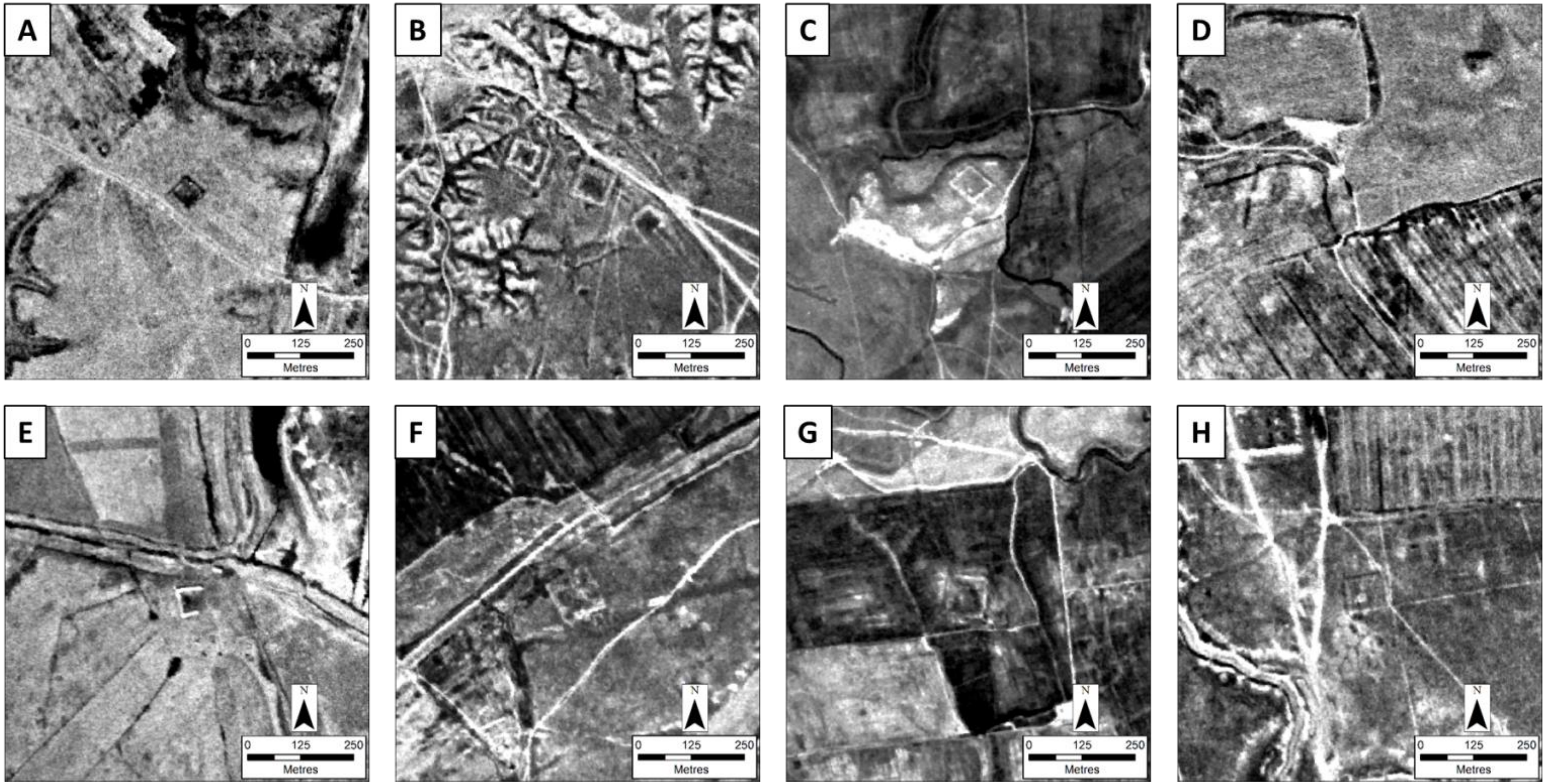


Table 7-2: Sites with rectilinear qal'ehs. Coordinates are in UTM 40N.

PARENT_ID	MORPHOLOGY	SITE SIZE (CORONA)	DATING INFORMATION (SOURCE)	COMMENTS	EASTING	NORTHING
GWS_15	Rectilinear qal'eh (square)	c. 1 ha	Iron Age III/IV, and possibly Parthian and Sasanian (Wilkinson et al. 2013)	Part of qal'eh and outer mound complex	272449	4115364
ARNE_139	Rectilinear qal'eh (square)	c. < 1 ha	No dating info	Likely originally square, but northeast corner has been cut or eroded out.	319783	4123270
ARNE_7	Rectilinear qal'eh (square)?	c. < 1 ha	Prehistoric (Arne 1945)	Small square qal'eh, relatively indistinct even on CORONA. Part of larger complex?	272267	4094469
ARNE_75	Rectilinear qal'eh (rectangular)	c. < 1 ha	Prehistoric (Arne 1945); Red, and red-brown polished pottery (Arne 1945, Shiomi 1976,78)	Qal'eh with outer mounds (overall site much larger).	277034	4105320
GWS_16	Rectilinear qal'eh (square)	c. < 1 ha	Iron Age III	Part of qal'eh and outer mound complex	277297	4113292
GWS_40	Rectilinear qal'eh (square)	c. < 1 ha	EBA (Abbasi 2011)	Interpreted as a fort or signalling station, but no ceramic assessment has been made of the GWS material. Gorgan Wall brick was found in graves on the mound. While not clear on the ground, soil discolouration and possible low mounding around the qal'eh may also represent the remains of a much larger site similar to other Iron Age through Parthian sites existing within the same sub-zone within the plain (the rain-fed steppe in the eastern plain to the north of the Gorgan River).	367415	4153778
KH_1	Rectilinear qal'eh	c. < 1 ha	Prehistoric, Islamic (Arne 1945)	Qal'eh within a complex of other mounds.	329471	4120573

PARENT_ID	MORPHOLOGY	SITE SIZE (CORONA)	DATING INFORMATION (SOURCE)	COMMENTS	EASTING	NORTHING
KH_10	Rectilinear qal'eh (square)	c. 3 ha	Islamic (Arne 1945)	Qal'eh within larger site which is itself vaguely rectilinear (c. 18 ha). Part of a potentially much larger site complex now cut by a modern road. Archaic field systems also immediately to the east of the site.	296373	4119526
KH_112	Rectilinear qal'eh (square)	c. < 1 ha	Islamic (Arne 1945)		289299	4098368
KH_118	Rectilinear qal'eh (square)	c. 1 ha	No dating info	Within 200m of a complex of mounds, perhaps part of the same site?	256658	4102359
KH_25	Rectilinear qal'eh (square)	c. 2ha	Iron Age III/IV, Parthian, Islamic (Abbasi 2011); Prehistoric (Arne 1945)		272921	4093086
KH_89	Rectilinear qal'eh (square)	c. 2 ha	No dating info	Part of larger site complex enclosed by ramparts.	302025	4121271
KH_95	Rectilinear qal'eh (square) with extension	c. < 1 ha	Prehistoric (Arne 1945)	Site with extension c. 1 ha	305479	4108084
KH_96	Rectilinear qal'eh (square)	c. 1 ha	No dating info	Small (c. < 0.1 ha) mound to the north east (c. 100m away)	303361	4105789
NTS_233	Rectilinear qal'eh (square)	c. < 1 ha	Bronze Age, Islamic (Abbasi 2011)	Part of larger mounded site with ramparts.	249084	4084225
TJW_5	Rectilinear qal'eh (square) and lower rectilinear extension	c. < 1 ha	No dating info	Might be related to NTS_205 occupied in the Sasanian and Islamic period. Lower extension is c. 3 ha.	276249	4109583

PARENT_ID	MORPHOLOGY	SITE SIZE (CORONA)	DATING INFORMATION (SOURCE)	COMMENTS	EASTING	NORTHING
TJW_8	Rectilinear qal'eh (square)	c. 2-3 ha	Appears to be part of the same site complex as mounds dated to the Iron Age III/IV, Parthian and Islamic periods (Abbasi 2011), but difficult to firmly establish.	Traces of canals leading to the site.	266999	4107784
GWS_50	Rectilinear qal'eh (square)	c. 2 ha	Prehistoric, Parthian and Sasanian (Kiani 1982b)	Use in the Sasanian period is strengthened by its incorporation into the Gorgan Wall.	268318	4112747
KH_147	Rectilinear qal'eh (square)	c. < 1 ha	Sasanian and Islamic (Abbasi 2011)	Part of a larger site complex. Outer mounds.	280764	4084404
KH_157	Rectilinear qal'eh (square)	c. < 1 ha	Iron Age III/IV, Achaemenid, Parthian, Sasanian, Islamic (Abbasi 2011)	Qanat associated with site?	363731	4135239
KH_34	Rectilinear qal'eh (square)	c. 3 ha	Parthian(?) and Sasanian (Abbasi 2011)		359200	4125805
NTS_279	Rectilinear structure	c. 2-4 ha	Bronze Age, Iron Age II/IV, Achaemenid, Sasanian, Islamic (Abbasi 2011)	Square features part of a larger site.	313638	4102299

Table 7-3: Morphology and size of sites dated to the Sasanian period that are visible on the CORONA imagery. Coordinates are in UTM 40N and indicate the location of the site on the CORONA imagery.

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
ARNE_42	c. 2 ha	Iron Age III/IV, Parthian, Sasanian and Islamic (Abbasi 2011). Dates are indicative of three sites in close proximity in this location. All had Sasanian material indicated.	In the central plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	At least two features. (1) Circular ovoid tappeh with lower town (?); (2) circular ovoid tappeh	At least two mounds. Ovoid tappeh with possible lower town located immediately to the east. Another shallower mound is located c. 120m to the east.	Large palaeochannel immediately west of the site. Possible field systems exist within the bed of the old channel which may have eroded away outer mounding to the north, west and east of the main tappeh.	304768 (centroid of grouping)	4100394 (centroid of grouping)
KH_105	c. 0.5 ha tappeh surrounded by low outer mounds covering an area of c. 11 ha. Similar size for the tappeh recorded by Shiomi (1978)	Sasanian and Islamic (Abassi 2011)	In the central plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Circular/ovoid tappeh with possible outer mounds	Clear circular tappeh surrounded by a depression. Lower mounds/soil colour difference appears to be visible to the north of the main mound, perhaps extending in a line c. 400m toward the north	Possible traces of older field systems. Several qanat lines run south/north to the east and west of the site.	305095	4093233

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
KH_176	Entire mound grouping is c. 5 ha (CORONA and Shiomi 1978)	Complex of mounds that are separated into at least three divisions by Abbasi (2011). One of these, likely the northernmost mound, was occupied in the Iron III/IV/, Achaemenid, Parthian, Sasanian and Islamic.	In the central plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Complex topographic mound	Complex topographic mound consisting of at least two roughly circular mounds, with a possible larger lower irregular mound. Soil colour different to the west of the mounds may also represent a further extension of the site. Modern village to the south of the mounds may obscure some of the site. It is difficult to tell how much of the site was occupied in various periods	Numerous roughly south to north running qanat lines in vicinity of site. Possible canal lines running to/from village/site.	300061	4093357
KH_66	c. 0.8 ha	Early and Middle Bronze Age, Parthian and Sasanian (Abbasi 2011)	In the central plain, south of the Gorgan Wall and immediately south of the Gorgan River	Circular/ovoid tappeh	Small prominent, roughly ovoid small tappeh.	On the opposite side of the river from the offtake of the canal south of Fort 18. It appears that the Gorgan River is cutting the east side of the site. Considerable area of archaic field systems to the south and east.	313982	4123245

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
KH_60	c. 1.3 ha	Sasanian (Abbasi 2011)	In the central plain, south of the Gorgan Wall and south of the Gorgan River	Double rectilinear tappeh	Tappeh composed of two roughly square mounds side by side.	Further mounding visible c. 400m to the NW of the site (KH_59)	329856	4116384
KH_3	Qal'eh c. 0.5 ha; entire site within possible ramparts c. 4.3 ha.	Iron Age III/IV, Parthian, Sasanian and Islamic (Abbasi 2011). Arne (1945) also noted Islamic pottery on the site.	In the central/eastern plain, south of the Gorgan Wall and immediately south of the Gorgan River	Rectilinear tappeh with depression and possible ramparts	Rectilinear tappeh with external depression (moat?) and possible outer ramparts	A canal-like feature with a possible length of at least 5km runs around the southwest corner of the site approximately 250 m away. The water for the canal may be coming from a channel extending from the Alborz Mountains and later feeding into the Gorgan River.	328252	4119229

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
ARNE_220	c. 8.5 ha	In the Abbasi (2011) dataset only part of the mounded complex is indicated as having been occupied in the Sasanian period. The overall site is also indicated as having been occupied in the Prehistoric periods, as well as the Iron Age III/IV, Parthian and Islamic periods.	In the eastern plain, near the Alborz foothills	Complex topographic mound	Complex topographic mound with a prominent roughly central circular tappeh attached on the east and south to a roughly rectilinear mound. The boundaries of the site are not particularly well defined. Abbasi (2011) divides the site into two parts Haji Sarmast A and B with only B being occupied in the Sasanian period. As such the site size during the Sasanian period is likely lower than the size of the entire site as viewed on CORONA.	Qanats are visible both north and south of the site running E-W parallel with the longest edge of the site. The northern qanat appears to end in a channel several hundred metres to the west of the site. The southern qanat may do similarly. As such, both qanats may be feeding fields to the west of the site, however, a direct relationship with the site is difficult to establish. A linear depression resembling a channel or canal can also be seen feature also exists to the north of the site parallel to the north of the tappeh. It may meet or be cut by the northern qanat c. 260m to the northeast of the site.	348220	4118032

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
ARNE_224	c. 0.8 ha	Parthian and Sasanian (Abbasi 2011)	In the eastern plain, near the Alborz foothills	Circular/ovoid tappeh	Small, roughly circular/ovoid tappeh. Possibly two conjoined mounds.	Palaeochannel channel located c. 220 m to the east of the site. Trace of a qanat line beginning c. 200m west and 325m north.	339758	4111730
KH_159	c. 1.5 ha	Early Bronze, Sasanian and Islamic (Abbasi 2011)	In the eastern plain, near the Alborz foothills	Rectilinear tappeh	Rectangular tappeh	Traces of two qanat lines (possibly two phases of the same line) running either to/from or immediately past the northern edge of the site. ASTER DEM would suggest that the qanat is leading away from the site to the west, but the resolution is low (c. 30m).	367712	4131281
KH_34	c. 3 ha	Parthian (?) and Sasanian (Abbasi 2011)	In the eastern plain, near the Alborz foothills	Rectilinear qal'eh	Small prominent square qal'eh.	A paleochannel or perhaps channelized canal runs immediately along the east side of the qal'eh. Other channels (relict and modern) running in the same direction are also visible within a kilometre.	359188	4125789

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
NTS_82	c. 0.3 ha	Parthian, Sasanian and Islamic (Abbasi 2011)	In the eastern plain, near the Alborz foothills	Circular/ovoid tappeh	Small circular tappeh.	Features north of the site which may be canals or channels perhaps related to traces of several qanat lines in the vicinity.	348431	4115624
KH_133	c. 0.7 to 4.3	Iron Age III/IV, Achaemenid, Parthian, Sasanian and Islamic (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and immediately south of the Gorgan River	Circular/ovoid tappeh with outer mounds	Prominent circular mound with a larger lower mound or mounds to the east. A modern village sits immediately west of the site and could be obscuring its western extent. Abassi (2011) divides the site into a least two parts, only one of which is occupied in the Sasanian period. As such the site size during the Sasanian period could be as low as c. 0.7 ha (the size of the promient circular mound) or as great as the size of the entire site as viewed on CORONA (4.3 ha).	The Aqabad canal takes its water from the Gorgan River c. 1.2 km to the north west of the site. Faint field systems on a different alignment to the modern field boundaries are visible less than 1km south of the site along with the traces of a qanat and a possible canal.	347020	4130907

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
ARNE_65	c. 5.5 ha	Painted and Islamic pottery noted in the Arne (1945) survey. Chalcolithic, Early Bronze Age, Iron Age III/IV, Parthian and Sasanian (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and River	Circular/ovoid tappeh	Ovoid tappeh surrounded by what appears to be a depression. A slight soil colour difference surrounding the depression may represent now ploughed out features.	Field systems not on the same alignment as the modern (c. 1960s) field systems are visible to the west of the tappeh.	347880	4121797
KH_157	c. 0.7 ha	Iron Age III/IV, Achaemenid, Parthian, Sasanian and Islamic (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and River	Rectilinear qal'eh with possible outer mounds	Small square qal'eh, with possible low mounding to the west and south (though south is under modern village).	A qanat runs around the east and north sides of the qal'eh. Numerous other qanats in the vicinity. C. 700m SW of the river that feeds that Sadd-e Garkaz.	363737	4135230

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
KH_32	c. 0.7 (main tappeh); c. 6 (larger site)	Overall site - Chalcolithic, Early Bronze, Iron Age III/IV, Parthian (?), Sasanian and Islamic (Abbasi 2011).	In the eastern plain, south of the Gorgan Wall and River	Circular/ovoid tappeh with outer mounds	Circular tappeh with visible mounding to the south and fainter but still possible lower mounding to the west. Abassi (2011) divides the site into a least two parts, with both occupied in the Sasanian period. However, it is difficult to correlate which features correspond to which division of the site on the CORONA.	Palaeochannel runs along the north eastern side of the tappeh possibly obscuring features on this side. Numerous qanats in vicinity, and one qanat line running along southern base of tappeh.	352214	4129844

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
KH_38	c. 0.7 ha	Parthian, Sasanian and Islamic (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and River	Circular/ovoid tappeh with rectilinear lower terrace	A small circular tappeh with a lower rectilinear mound to the north. Soil colour discolouration in the vicinity of the site might represent outer portions of the site.	A double qanat line runs east to west from the vicinity of river feeding the Gorgan River. The site is c. 500m to the SW from the above mentioned feeder river. A possible canal may run immediately past the northern edge of the site. It likely takes its water from the channel to the east suggesting that it runs toward the west. Possible traces of older field systems in the vicinity.	348884	4125569
KH_45	1 ha	EBA, Parthian, Sasanian and Islamic (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and River	Complex topographic mound	A roughly circular tappeh with complex topography. What appears to be a depression surrounds the tappeh on the north, west and south sides.	A qanat runs past the north side of the site likely from east to west. What appear to be archaic field boundaries are visible to the south and east of the site.	346264	4124840

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
NTS_1	c. 3.8	Prehistoric, Parthian, Sasanian and Islamic (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and River	Irregular tappeh or mounded structure.	Irregular tappeh or mounded structure.	A qanat leads to the site, running from south east to north west and appears to continue in a channel that cuts across the site suggesting a later date for the qanat. At least two other qanats are visible to the south of site apparently leading past it toward the northwest and what may be the remains of archaic field systems.	345884	4118700
NTS_108	c. 0.5 ha	Sasanian and Islamic (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and River	Irregular tappeh or mounded structure.	Irregular tappeh or mounded structure.	A qanat runs to the site (roughly from the east).	368190	4132803

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
NTS_146	c. 1 ha	Neolithic, Iron Age III/IV, Achaemenid, Parthian, Sasanian and Islamic (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and River	Low rounded mound	Low rounded mound	Immediately south of a river which feeds into the Gorgan River. The site is only 300 m to the north of KH_38, another site identified as having a Sasanian component. Equally, the site sits c. 1 km to the SW of Gabri Qal'eh. While the course of the river may have altered over time, there is little evidence for significantly different palaeochannels in the vicinity of the site.	348901	4125884

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
NTS_309	c. 2.8 ha	Prehistoric, Sasanian and Islamic (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and River	Irregular tappeh or mounded structure.	Irregular tappeh or mounded structure.	The Gorgan River runs immediately north of the site, while a relict meander runs around the north, east and south of it. This meander may have provided a protective loop around the site in certain periods. The site is approximately. 1.2 km south of the offtake for the Aqabad Canal.	345612	4130537
NTS_39	c. 1.3 ha	Parthian and Sasanian (Abbasi 2011)	In the eastern plain, south of the Gorgan Wall and River	Circular/ovoid tappeh	Small ovoid tappeh.	Qanat runs to the east of the site (s-n) past the modern village to the north of the tappeh. Clear traces of field boundaries on a different alignment to the modern field systems.	338598	4111255

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
NTS_8	c. 0.7 ha	Sasanian and Islamic (Abassi 2011)	In the eastern plain, south of the Gorgan Wall and River	Circular/ovoid tappeh	Small circular/ovoid tappeh.	Palimpsest of field systems all around the site. Several qanats running roughly (I assume) east to west both north and south fo the site. C. 1.4 km from the stream/river that feeds the Sadd-e Garkaz	361290	4136266
ARNE_78	c. 0.7 ha; Similar size recorded by the HUS survey.	Iron Age III/IV, Parthian and Sasanian (Abbasi 2011). Arne (1945) suggested some Islamic pottery as well.	In the western plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Circular/ovoid tappeh	Small mound which may originally have been ovoid or rectangular with rounded corners		263922	4092565
ARNE_86	c. 0.2 ha recorded by the GWS survey and the HUS survey.	Parthian, Sasanian and Islamic (Abbasi 2011)	In the western plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Circular/ovoid tappeh with possible outer mounds	Small circular tappeh with possible outer mounding to the east and north.	Patchwork of irregular field systems surrounding the site. Anomalies present to the south west of the site.	264978	4085216

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
KH_147	c. 1 ha qal'eh, with outer mounds possibly equating with occupation up to 17 ha.	Sasanian and Islamic (Abassi 2011)	In the western plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Rectilinear qal'eh with possible outer mounds	Small squarish qal'eh with possible mounding to the north and west.	Irrigation channels appear to run along the eastern edge of the site and extend to the north. Difficult to determine age based on imagery. Numerous qanats are visible running south/north in the vicinity of the site, including one which may have fed into the above mentioned irrigation channels to the south east of the site.	280830	4084159
KH_148	c. 1 - 2 ha (CORONA and HUS survey).	Chalcolithic, Bronze Age, Iron Age III/IV, Achaemenid, Parthian and Sasanian (Abbasi 2011)	In the western plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Circular/ovoid tappeh	Small prominent circular tappeh.	Immediately to the east of the stream flowing from the Alborz northwest into the plain.	258077	4076433
KH_152	c. 0.5 ha.	Sasanian and Islamic (Abassi 2011)	In the western plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Circular/ovoid tappeh	Small prominent ovoid tappeh	Possibly relict loop of a stream borders the north side of the tappeh. It may have cut into it.	287757	4085685

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
KH_153	c. 0.6 ha (CORONA), with up to 1.2 ha indicated in the HUS survey.	Middle Bronze Age, Iron Age III/IV, and Sasanian (Abbasi 2011)	In the western plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Circular/ovoid tappeh	Small prominent circular tappeh. Designation of 'north' in site names for the MB site might indicate a slightly different spatial unit.	At the northern extreme of the alluvial fans.	295042	4097173
KH_161	c. 3 ha	Chalcolithic, Bronze Age, Iron Age III/IV, Achaemenid, Parthian and Sasanian (Abbasi 2011)	In the western plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Complex of low mounds	Complex of at least two ovoid mounds		243095	4080839
KH_165	c. 2 ha	Chalcolithic, Bronze Age, Iron Age III/IV, Achaemenid, Parthian, Sasanian and Islamic (Abbasi 2011)	In the western plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Circular/ovoid tappeh	Prominent semi-circular tappeh	Modern village to east and some of the area is under tree cover. Streams running down from the Alborz within 1 or 2km of site.	247800	4075734
NTS_61	c. 3.8 ha	Bronze Age, Iron Age III/IV, Sasanian (Abbasi 2011)	In the western plain, south of the Gorgan river and wall, within c. 20km of the Alborz foothills	Circular/ovoid tappeh	Roughly ovoid or irregular tappeh with features at north east end.	Immediately east of a minor stream, channelized canal running north. Palimpsest of field systems in the area.	247617	4079266

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
KH_149	c. 4.6 ha (tappeh) c. 7 ha (enclosure)	Sasanian and Islamic (Abassi 2011)	In the western plain, south of the Gorgan Wall	Irregular tappeh and rectilinear enclosure with internal features	Crescent shaped tappeh, overlooking what appears to be a roughly rectilinear enclosure distinguished by an internal soil colour difference (mottling possibly representing internal features) and with possible ramparts on the southern and western sides.	Within a loop of a relict meander of a palaeochannel of the Gorgan River. The palaeochannel appears to form the north and east boundaries of the site.	245376	4107073
KH_151	c. 16 ha (c. 12 ha recorded on HUS maps - Shiomi 1976-78)	Iron Age III/IV, Parthian and Sasanian (Abbasi 2011).	In the western plain, south of the Gorgan Wall but within meander loop of a relict channel of the Gorgan River	Complex topographic mound with qal'eh	Complex topographic mound, irregular in shape, with a prominent square qal'eh on its eastern extremity.	A relict meander of the Gorgan River forms the border of the northern and western sides of the site. Possible offsite features are visible to the southeast. Two possible canals are also visible to the south and east.	268841	4105108

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
GWS_31	Bibi Shervan. The qal'eh appears to be c. 3.6 ha on the imagery, and at least 2 ha recorded by the GWS survey. A much larger lower town may exist to the south. A complex site and as such it is difficult to tell how much of the site would have been occupied in each period.	GWS lab assessment indicated Bronze Age/ Early Iron Age?, Iron IV, Parthian, Early Sasanian, and some Islamic (Wilkinson et al. 2013). Iron Age III/IV, Achaemenid, Parthian, Sasanian and Islamic (Abbasi 2011). Kiani (1982b) suggested the site was Sasanian.	In the western plain, immediately south of the Gorgan River.	Rectilinear tappeh	A roughly rectilinear mound. Possible mounding to the north and east of the main mound now partly eroded out by a relict meander of the river. Anomalies on the imagery to the south of the mound are possibly part of a lower town.	Relict meanders of the Gorgan River pass by the north and south sides of the mound. A possible lower town as well as many small relict field systems are located to the south of the site.	309201	4123100

PARENT_ID	SIZE - FROM CORONA UNLESS OTHERWISE SPECIFIED	DATING	LOCATION	MORPHOLOGICAL CATEGORY	COMMENTS ON SITE MORPHOLOGY (CORONA) AND SIZE	ADDITIONAL SITE FEATURES	EASTING	NORTHING
GWS_9	C. 0.5 ha on the CORONA and c. 1.5 ha recorded in the field. HUS indicates a similar site size to that recorded by the GWS in the field.	Lab assessment of the GWS sample suggested the possibility of an earlier Sasanian assemblage based on possible associations with wares from Fort 4 and Qal'eh Kharabeh. Also possibly Bronze Age.	In the western plain, south of the Gorgan Wall	Circular/ovoid tappeh	Low ovoid tappeh.		264958	4111332

Table 7-4: Aggregate occupied area by period for the Late Iron Age through Parthian horizon, and the Sasanian Period.

	CATEGORIES	LATE IRON AGE THROUGH PARTHIAN	SASANIAN	COMMENTS
Survey datasets	**A**) Number of sites from survey and excavation datasets	398	128*	* includes forts on the Gorgan Wall and possible temporary occupation sites (i.e. campaign bases)
	B) Number of sites from row A with site size info (from survey or CORONA)	270	101	
CORONA	**C**) Number of additional sites attributed to each period based on morphology (not included in above totals) (e.g. possible Sasanian rectilinear enclosures)	19	15	* This does not include all sites that may have morphological similarities, but those specifically analysed for this study.
	Aggregate occupied area of B	1242 (min), 3596 (max)	1247 (min), 1675 (max)	
	Aggregate occupied area of C	138 (min), 259 (max)	119 (min), 127 (max)	

Table 7-5: Sites above 30 ha located on the imagery or in field survey.

PARENT_ID	NAME	APPROX. SITE SIZE	SOURCE FOR SIZE DATA	BOUNDARY CERTAINTY	NOTES	DATING
KH_138	Jurjan	1264	CORONA/Kiani 1984	Medium/ High	Urban site.	Islamic (Kiani 1984)
GWS_54	Dasht Qal'eh	372 (c. 338 ha within the ramparts)	CORONA	Definite	Urban site. Site at greatest extent appears to have been constructed in Sasanian period.	Bronze Age, Sasanian, Islamic (GWP excavations); Prehistoric, Parthian, Sasanian, Middle Islamic (Kiani 1982b); Sasanian (Abbasi 2011)

PARENT_ID	NAME	APPROX. SITE SIZE	SOURCE FOR SIZE DATA	BOUNDARY CERTAINTY	NOTES	DATING
GWS_50	Qizlar Qal'eh	136	CORONA/GWS Survey	High	May have reached maximum site size in Iron Age - Parthian period, but later incorporated into the Gorgan Wall. Kiani 1982b indicates and area over twice as large on his map, but this may include field systems and other features.	Prehistoric, Parthian, Sasanian (Kiani 1982b)
GWS_37	Qal'eh-ye Pol Gonbad	126	CORONA	Definite	Sasanian based on morphology? Military?	None

PARENT_ID	NAME	APPROX. SITE SIZE	SOURCE FOR SIZE DATA	BOUNDARY CERTAINTY	NOTES	DATING
GWS_19	Malek A'li Tappeh	103	CORONA/GWS Survey	Medium	Could be anywhere between 23 and 103 ha. Likely reaches maximum size in Islamic period.	Parthian (?), Sasanian (?), Middle Islamic, (GWS); Iron Age III/IV, Achaemenid, Parthian, Sasanian, Islamic (Abbasi 2011)
KH_4	no name	96 (?)	Kiani 1982b	Low	The size of the site as indicated on the Kiani (1982b) map might be exaggerated. The main mounding of the site visible on the CORONA is bordered on the east, west, and south by field systems and other features.	Chalcolithic, Iron Age III/IV , Islamic (Abbasi 2011)
TJW_1	Agh Qal'eh	87	CORONA/GWS Survey	High	Fort	Safavid

PARENT_ID	NAME	APPROX. SITE SIZE	SOURCE FOR SIZE DATA	BOUNDARY CERTAINTY	NOTES	DATING
GWS_15	Mangali	85	CORONA/GWS Survey	Medium		Iron Age III, Iron Age IV, Parthian (?), Sasanian (?), Islamic (?) (Wilkinson et al. 2013)
GWS_16	Qelich Qoineq	81	CORONA/GWS Survey	Medium		Iron III (GWP Excavations)
KH_84	Unnamed	77	CORONA	High	Sasanian based on morphology? Military?	None
GWS_21	Abadan Tappeh-ye Kuchek	72	CORONA/GWS Survey	High	Likely reaches maximum size in Islamic period.	Iron Age IV, Parthian (?)(GWS); Prehistoric, Middle Islamic, Seljuk (Kiani 1982b); Parthian, Sasanian (Abbasi 2011);

PARENT_ID	NAME	APPROX. SITE SIZE	SOURCE FOR SIZE DATA	BOUNDARY CERTAINTY	NOTES	DATING
KH_121	GWS-62	71	CORONA	Medium/High	Possible further example of geometric enclosure with limited internal features; however, the grouping of mounds on west side of site could represent a settlement.	Painted and red-brown pottery (Shiomi 1976-78; MBA, Iron Age III/IV, Achaemenid, Parthian, Islamic (Abbasi 2011)
GWS_6	Nurjan Tappeh	64	CORONA/GWS Survey	Medium		Bronze Age? Iron Age? (GWS); Prehistoric, Parthian and Sasanian (Kiani 1982b)
GWS_55	GWS-55	62	CORONA	High	Sasanian based on morphology? Military?	None
GWS_49	Gabri Qal'eh	59	CORONA/GWS Survey	Definite	Corner citadel may be earlier, but enclosure is likely Sasanian.	Sasanian, Islamic (GWS); Prehistoric, Parthian, Sasanian, Middle Islamic (Kiani 1982b); Iron Age III/IV, Sasanian, Islamic (Abbasi 2011)

PARENT_ID	NAME	APPROX. SITE SIZE	SOURCE FOR SIZE DATA	BOUNDARY CERTAINTY	NOTES	DATING
GWS_59	Qal'eh Sultan Ali	58	CORONA/Kiani 1982b	High		Prehistoric, Parthian, 1st millennium BC (Kiani 1982b); EBA, MBA (Abbasi 2011)
KH_33	Qal'eh Paras (Kiani 1982b)	57	CORONA/Kiani 1982b	High		Parthian, Middle Islamic (Kiani 1982b)
KH_175	Suli/Sul Tappeh (Abbasi 2011; Arne 1945)	56	CORONA	Low	Difficult to assess site size, but appears to spread over a large area	Iron Age III/IV, Parthian, Islamic (Abbasi 2011)
GWS_53	Qal'eh Daland	53	CORONA	Definite	Likely Sasanian based on morphology. Military?	Parthian, Sasanian (Kiani 1982b)
GWS_33	Qal'eh Gug A	50	CORONA	Definite	Military?	Neolithic, Iron Age IV, Parthian, Sasanian, Islamic (GWS); Islamic (Arne 1945); Prehistoric, Parthian, Islamic (Kiani 1982b); EBA, Parthian (Abbasi 2011)
GWS_1	Qal'eh Kharabeh	49	CORONA/GWS Survey	Definite	Military?	Sasanian (GWS excavations)
KH_2	Gomish Tappeh	44	KH7	Medium		Prehistoric (Arne 1945); Islamic

PARENT_ID	NAME	APPROX. SITE SIZE	SOURCE FOR SIZE DATA	BOUNDARY CERTAINTY	NOTES	DATING
GWS_20	Abadan Tappeh-ye Bozorg	40	CORONA/GWS Survey/ Kiani 1982b			Iron Age IV, Parthian?, Sasanian? (Wilkinson et al. 2013); Sasanian, Islamic (Abbasi 2011)
GWS_4	Tokhmaq Tappeh	36	CORONA/GWS Survey	Definite		Iron Age IV, Parthian (?), Sasanian (?), Late Islamic (GWS); Prehistoric, Parthian, Sasanian, Islamic (Kiani 1982b)
GWS_44	Qareh Qoli	31	CORONA/GWS Survey	High		Sasanian (?), Islamic (?) (GWS); Parthian, Islamic (Abbasi 2011)
GWS_8	Hevaz Yalanchi	30	CORONA/GWS Survey	Medium	Difficult to assess site size, but appears to spread over a large area	Bronze Age? Iron Age? (GWS)

Figure 7-7: Forts with confirmed extramural settlement shown on CORONA imagery (imagery available from the US Geological Survey). A) Fort 4; B)Fort 16; C) Fort 18; D) Fort 28.

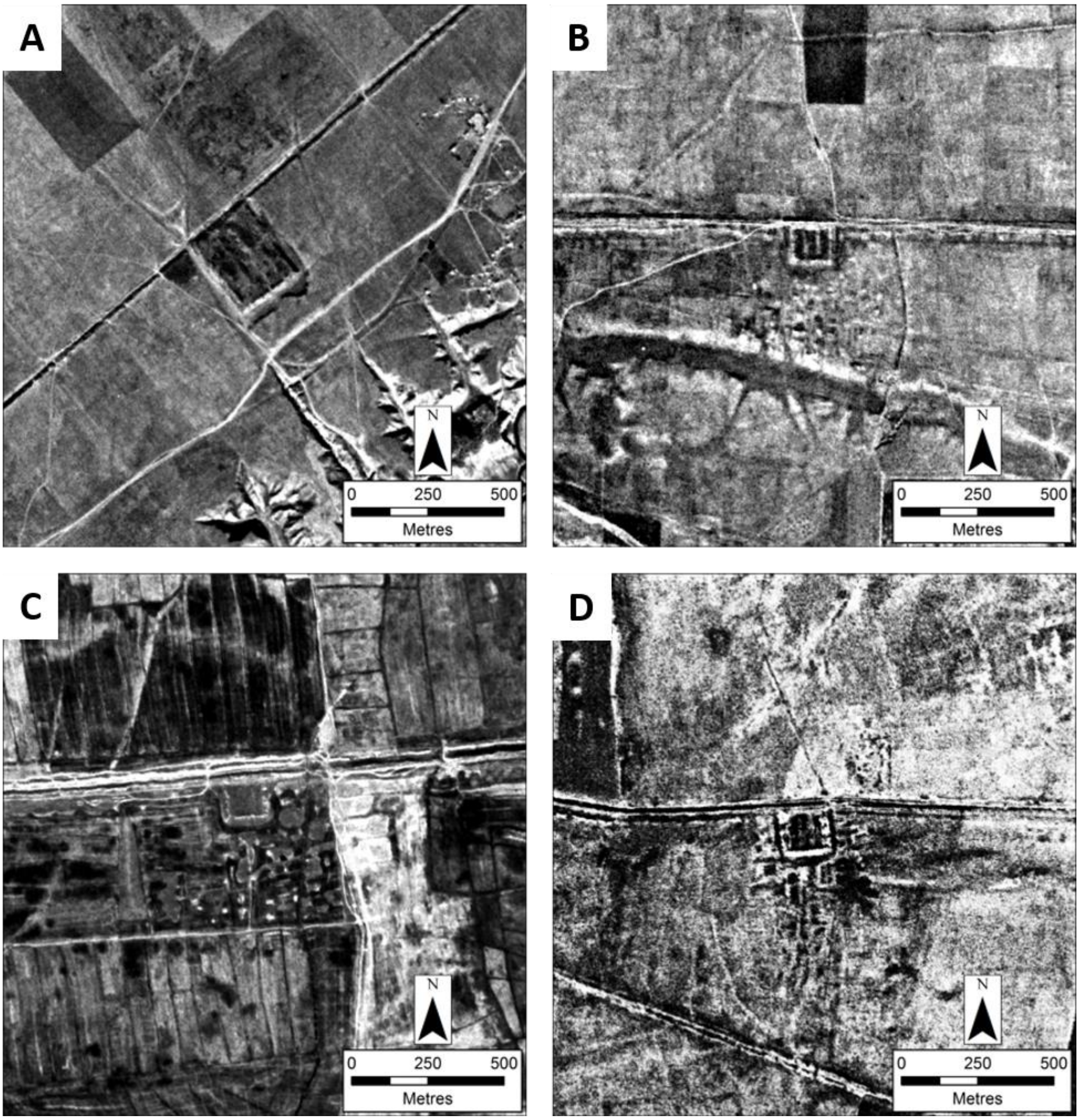


Figure 7-8: Sites discussed in relation to Sasanian period activity along the wall corridor in the western plain. Forts in italics hav e possible extramural settlement, while forts labelled in bold italics have confirmed extramural settlement.

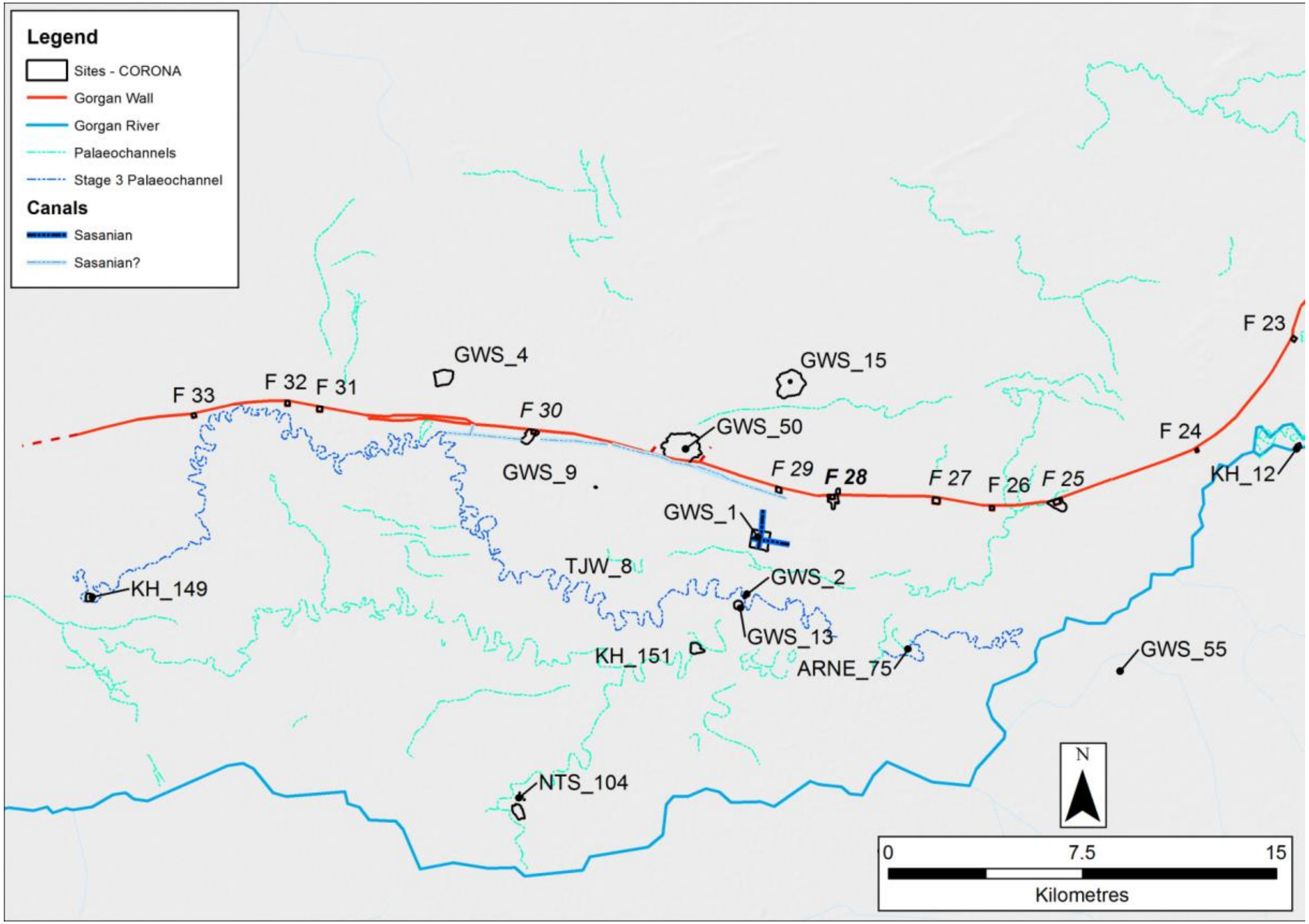


Figure 7-9: Sites discussed in relation to Sasanian period activity along the wall corridor in the central plain.

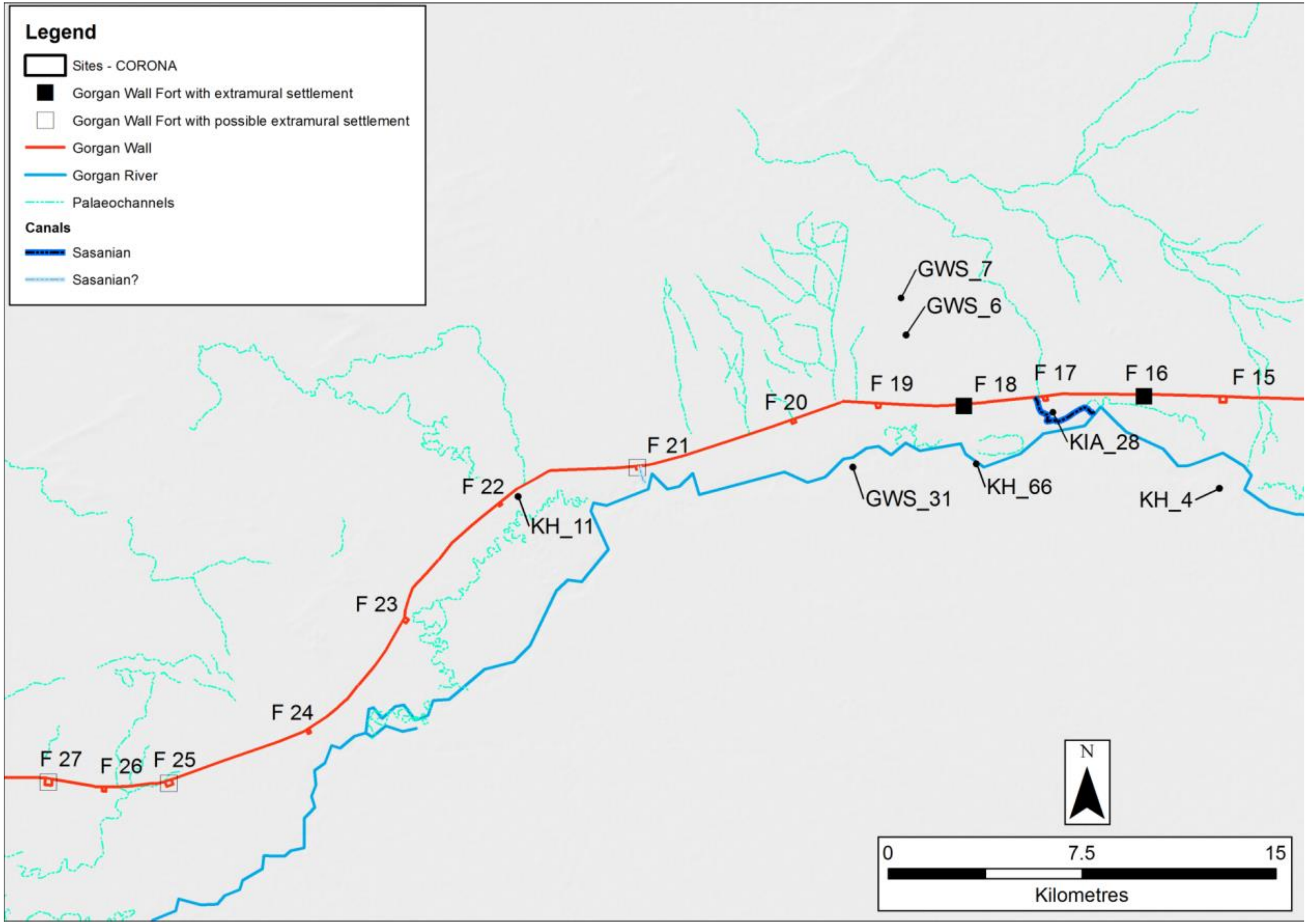


Figure 7-10: Sites discussed in relation to Sasanian period activity along the wall corridor in the eastern plain. Basemap – SRTM 90 m hillshade (Data available from the US Geological Survey). Site IDs in grey italics are not visible on the CORONA imagery.

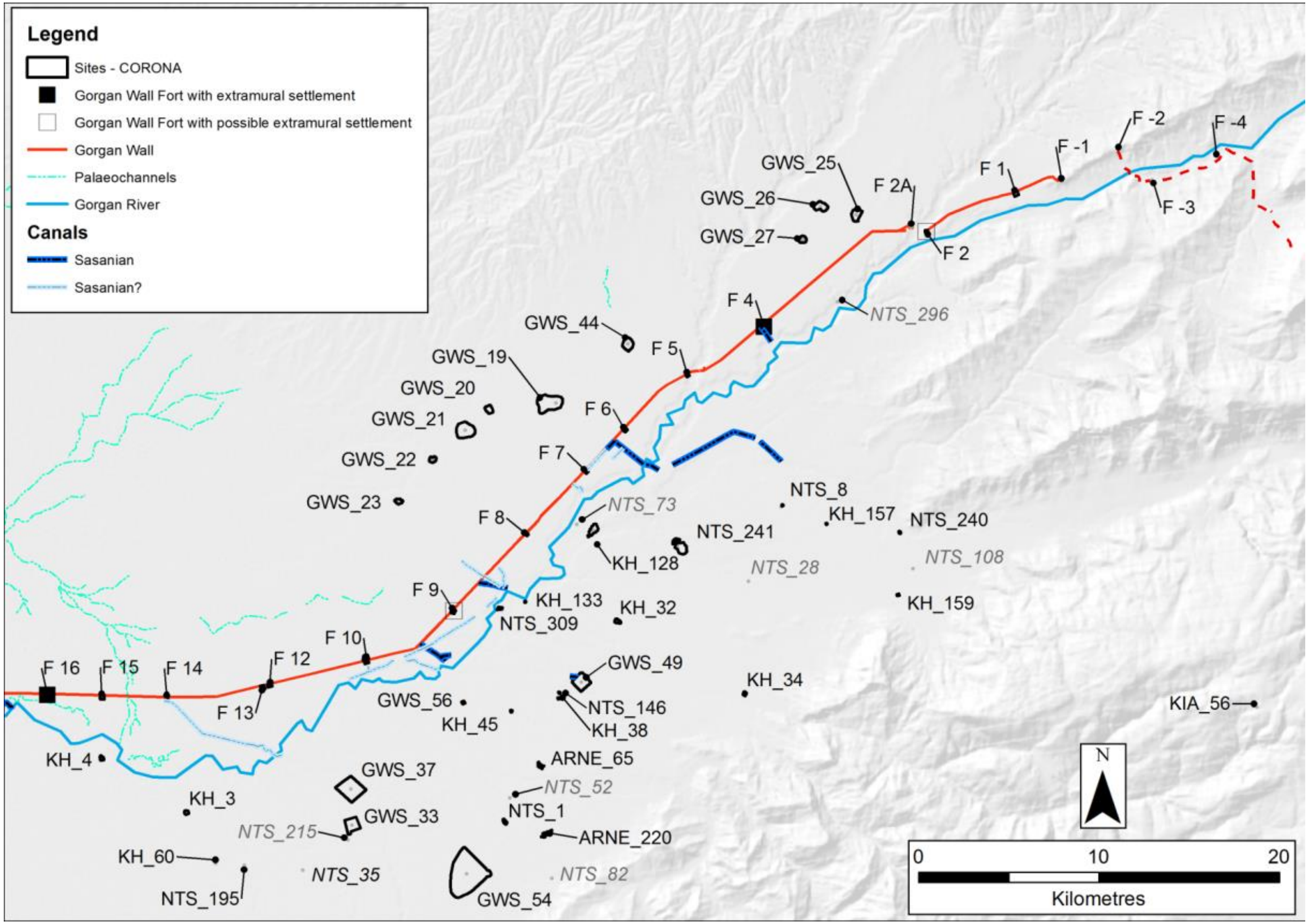


Table 7-6: Sites with possible Sasanian components to the north of the Gorgan River. S = Sasanian, ES = Early Sasanian, X = Period assessment available, but no evidence for Sasanian. The certainty of the assessments is discussed in the text.

PARENT_ID	LOCATION	GWS PRELIMINARY FIELD ASSESSMENT	LABORATORY ASSESSMENT OF GWS SAMPLE	ABBASI (2011)	KIANI (1982b)
GWS_4	Western steppe margins	**S**	**ES?**	No info	**S**
GWS_6	Central steppe margins	No date assigned in field	X	No info	**S**
GWS_7	Central steppe margins	No date assigned in field	**ES?**	No info	No info
GWS_15	Western steppe margins	**S**	X	No info	No info
GWS_19	Eastern dry-farming zone	**S**	No assessment	**S**	No info
GWS_20	Eastern dry-farming zone	**S**	X	**S**	No info
GWS_21	Eastern dry-farming zone	X	X	**S**	X
GWS_22	Eastern dry-farming zone	X	X	**S**	X
GWS_23	Eastern dry-farming zone	**S**	X	X	No info
GWS_25	Eastern dry-farming zone	**S**	**ES?**	X	No info
GWS_26	Eastern dry-farming zone	**S**	X	X	No info
GWS_27	Eastern dry-farming zone	**S**	X	X	No info
GWS_44	Eastern dry-farming zone	**S**	No assessment	X	No info

Table 7-7: Canal Systems associated with the Gorgan Wall and its forts (data from Wilkinson et al. 2013: 72-80). Canals indicated in italics were located on the imagery but not visited in the field.

CANAL NAME	LENGTH	WIDTH	DEPTH	DESCRIPTION	DATING
Chai Qushan-e Kuchek	c. 2km	10m	<0.75m	Leads from the Sadd-e Garkaz aqueduct to the ditch on the north side of the Gorgan Wall. Two branch canals exists at a right angle to the main canal.	Sasanian based on presence of Gorgan Wall brick, association with the wall, and 19th century descriptions associating the aqueduct and the canal
Sadd-e Garkaz	c. 900m (entire construction)	80m at base, c. 5-6 m at top	-	Aqueduct taking its water from the Kal-e Garkaz canal.	
Kal-e Garkaz	c. 7.5km	c. 10-15m (CORONA)	-	Canal leading to the Sadd-e Garkaz; takes its water from the Rudkhanehye Dugh.	
Aqabad	c. 1.6km	c. 11-17m	c. 3m	Canal leading to the wall ditch from the Gorgan River (any evidence of the offtake is eroded out by the modern river) (Wilkinson et al. 76).	Sasanian based on association with the wall.
Sarli Makhtum	c. 1.2 km (main canal), north branch c. 650m, south branch, c. 450 m	c. 19 m	-	Two canal branches merge c. 1.3km south east of the wall to form the main canal that was visited by the *GWS* team in the field. The canal enters the wall ditch through a gap in the wall. The canal may have taken its water from the Gorgan river, but an association with a canal/qanat line aligned with the north branch of the canal is possible.	Sasanian based on association with the wall.
Band-e Vali	c. 3.2 km	c. 18 m	At least 1.5 m	Follows a winding course from the Gorgan River toward the west before turning north and eventually entering the wall ditch. Appears to utilise the course of a Stage 1 palaeochannel of the Gorgan River (see above).	Sasanian based on association with the wall.

CANAL NAME	LENGTH	WIDTH	DEPTH	DESCRIPTION	DATING
Possible canal west of Fort 4	c. 1 km	-	-	Along the western side of Fort 4, extending from the Gorgan Wall toward the Gorgan River. The southern end has been destroyed by erosion making it difficult to interpret.	Possibly Sasanian based on association with the wall and Fort 4.
Possible canal west of Sārlī Makhtūm	c. 600m (possibly extending a further c. 1.4 km)	-	-	The distinct canal-like feature cannot be clearly associated with the Gorgan Wall. A faint trace may link it to the Gorgan River.	Possibly Sasanian based on proximity to wall, but no relationship could be established.

Table 7-8: Canals located on the CORONA imagery but not visited in the field.

	LENGTH	WIDTH	DESCRIPTION FROM CORONA IMAGERY	DESCRIPTION ON IMAGERY AVAILABLE ON GOOGLE EARTH	DATING
Possible canal west of Fort 7	a) c. 700 m b) c. 300 m	a) c. 10-15m b) 18-20 m	A dark linear feature (a) leads from the Gorgan River toward the wall. The feature is cut by modern tracks. A second possible canal (b), beginning in roughly the same location, is visible to the east of the first running on a slightly different alignment but still heading towards the wall. The relationship between this feature and the wall cannot be clearly ascertained.	The longer of these two features (a) is still visible on imagery from May 2013 available on Google Earth where clear banks, are visible, as well as a ditch represented by differential vegetation growth.	Contemporary with the Gorgan Wall or Pre-Gorgan Wall? If it is earlier it is impossible to ascertain without further investigations in the field.
Possible canal from the vicinity of Jurjan to west of Fort 14	c. 8 km	c. 10-15 m	A possible canal features leads from near the Gorgan River within the ruins of the site of Jurjan toward the northwest and the Gorgan Wall. The feature may skirt to the south of Fort 14 before turning to the wall.		Sasanian? Islamic? Clearly extending from the Gorgan River in the vicinity of Jurjan. The canal may feed into the wall ditch.
Possible canal east of Fort 21	c. 700m	-	A dark linear feature leads from the vicinity of the Gorgan River to the wall immediately to the east of Fort 21. No clear relationship between the feature and the wall can be ascertained.		?

Figure 7-11: Canals on the Gorgan Plain. Canals dating to the Sasanian period are highlighted in bold, while those in italics are likely associated with a Late Iron Age through Parthian horizon (though a few may have been reused in the Sasanian period). The rest are of uncertain date, but some, particularly in the eastern part of the plain may also have been associated with the Gorgan Wall.

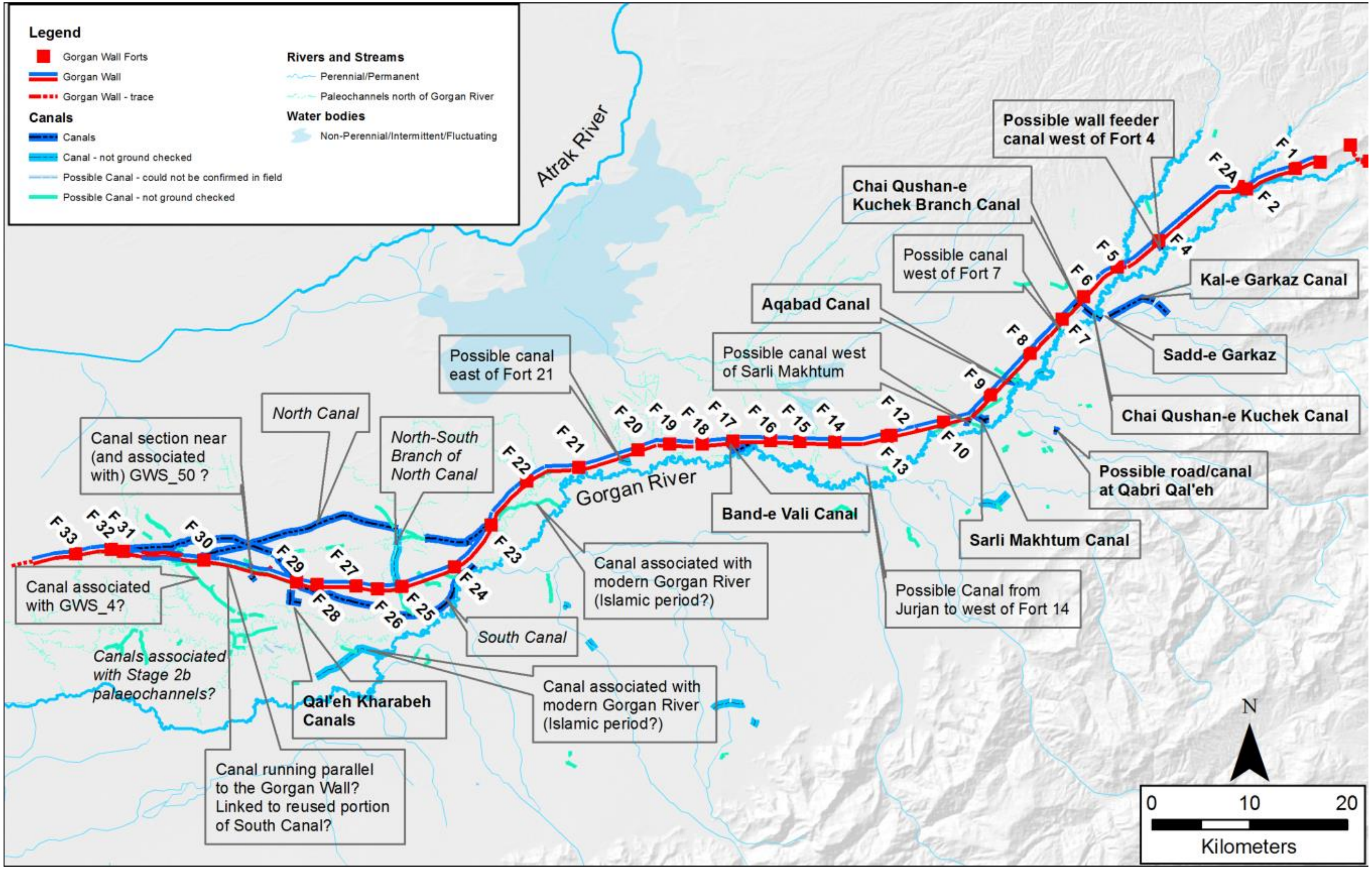


Figure 7-12: Possible canal feature to the west of Fort 7.

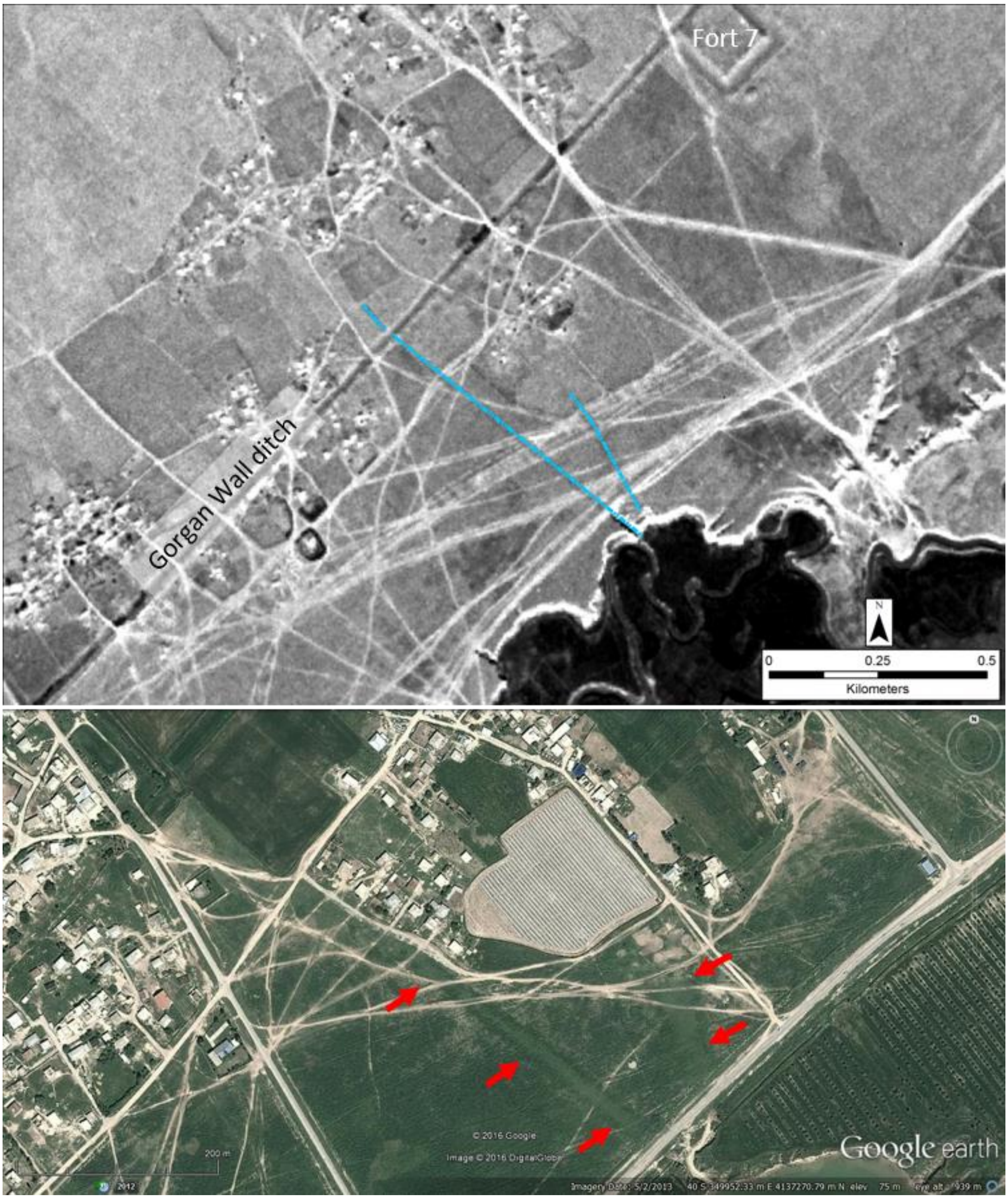


Figure 7-13: Agabad Canal and other possible canal features.

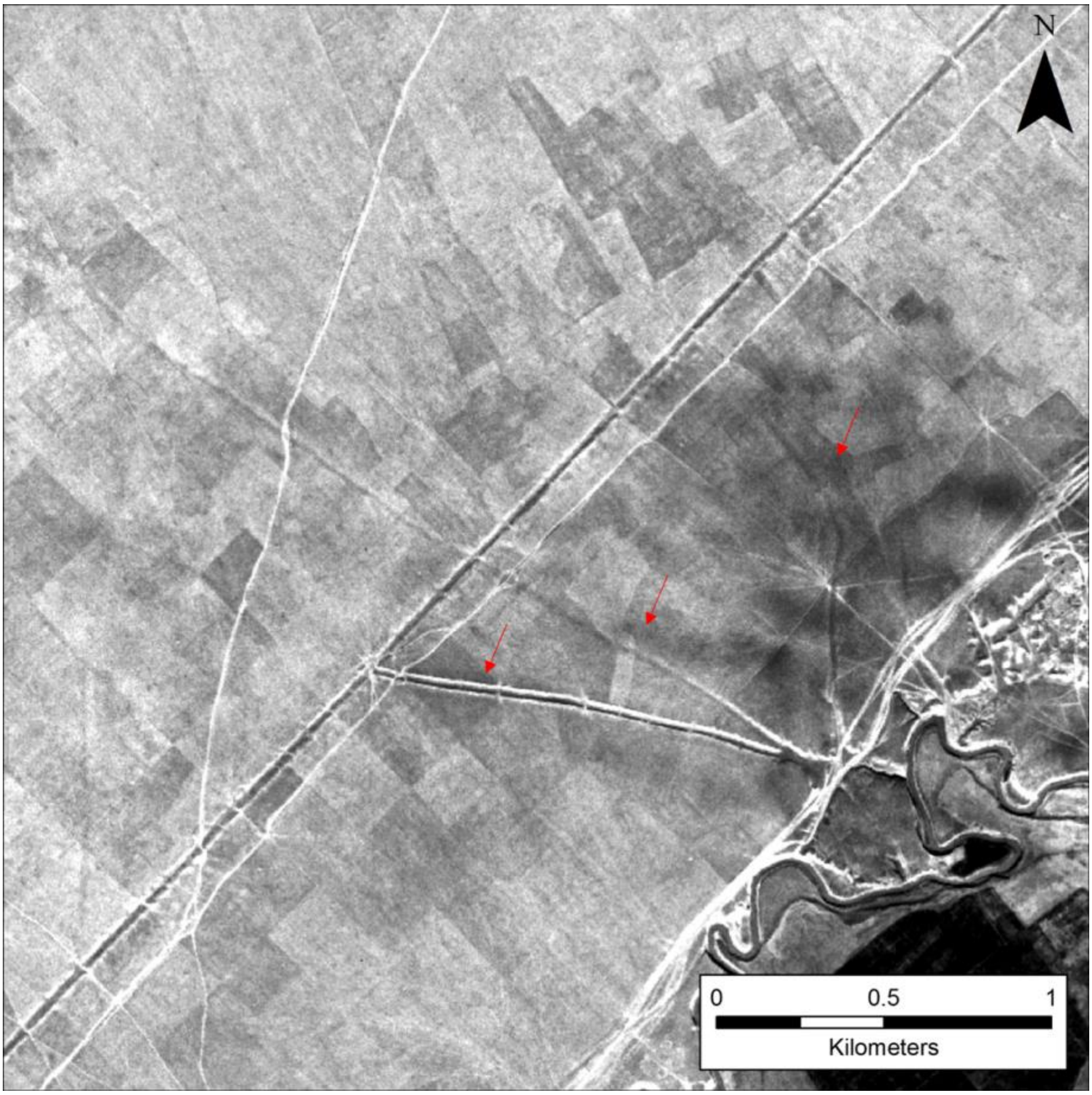


Figure 7-14: Possible canals in the vicinity of the Sarli Makhtum Canal, and Forts 9 and 10 on the CORONA imagery (available from the US Geological Survey).

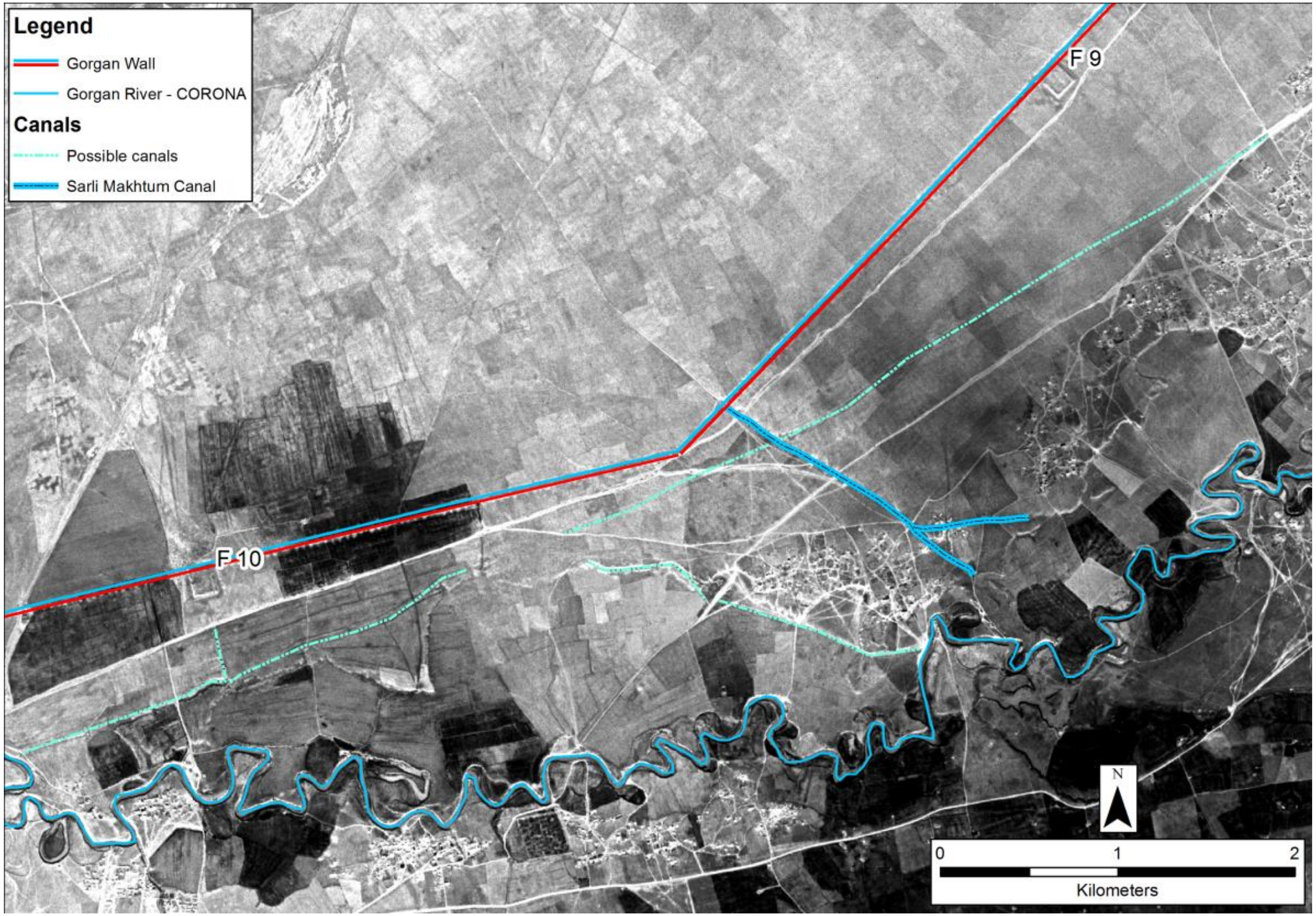


Figure 7-15: Possible canal near Fort 14 and Jurjan.

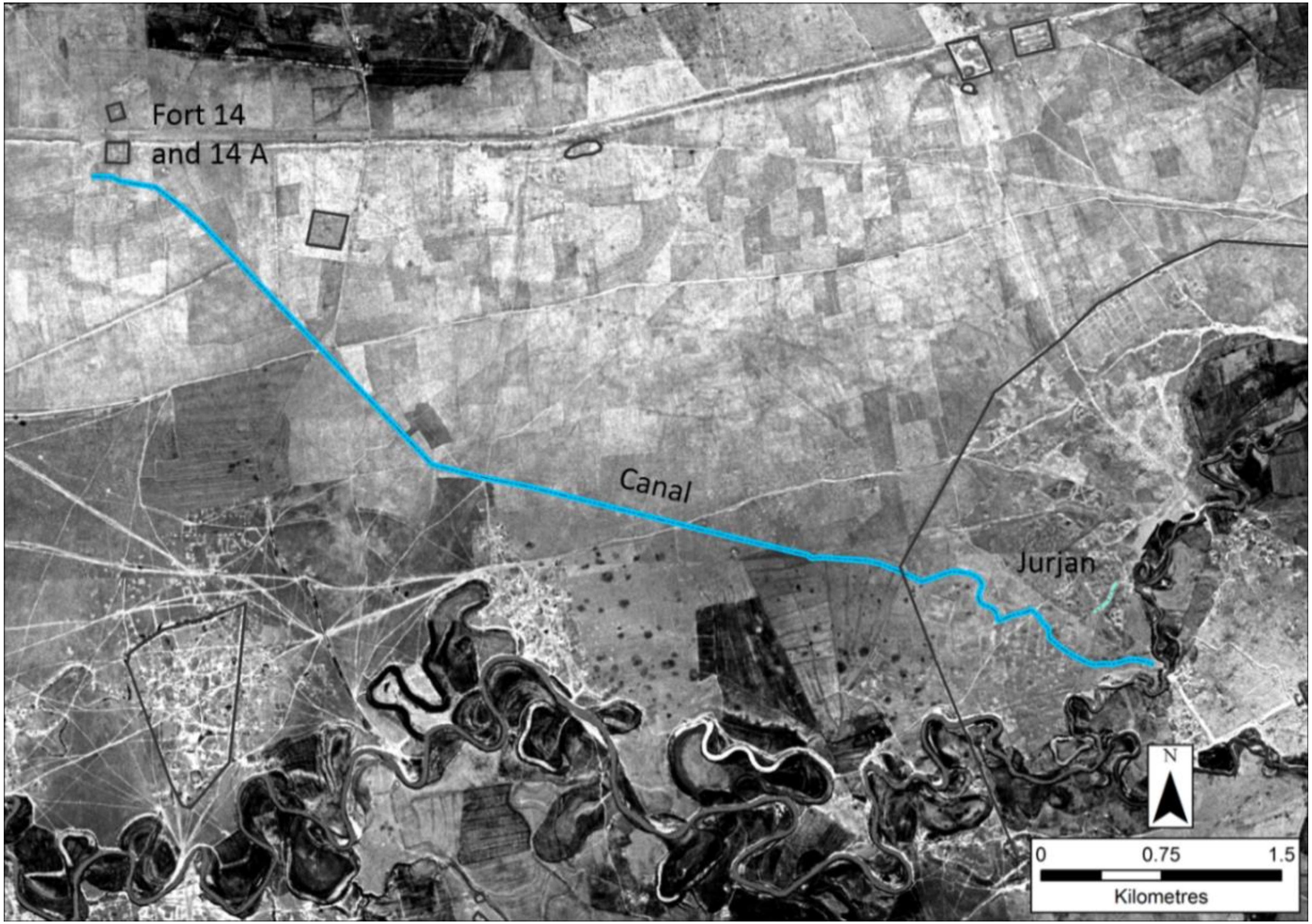


Figure 7-16: Start of possible canal near Fort 14 and Jurjan

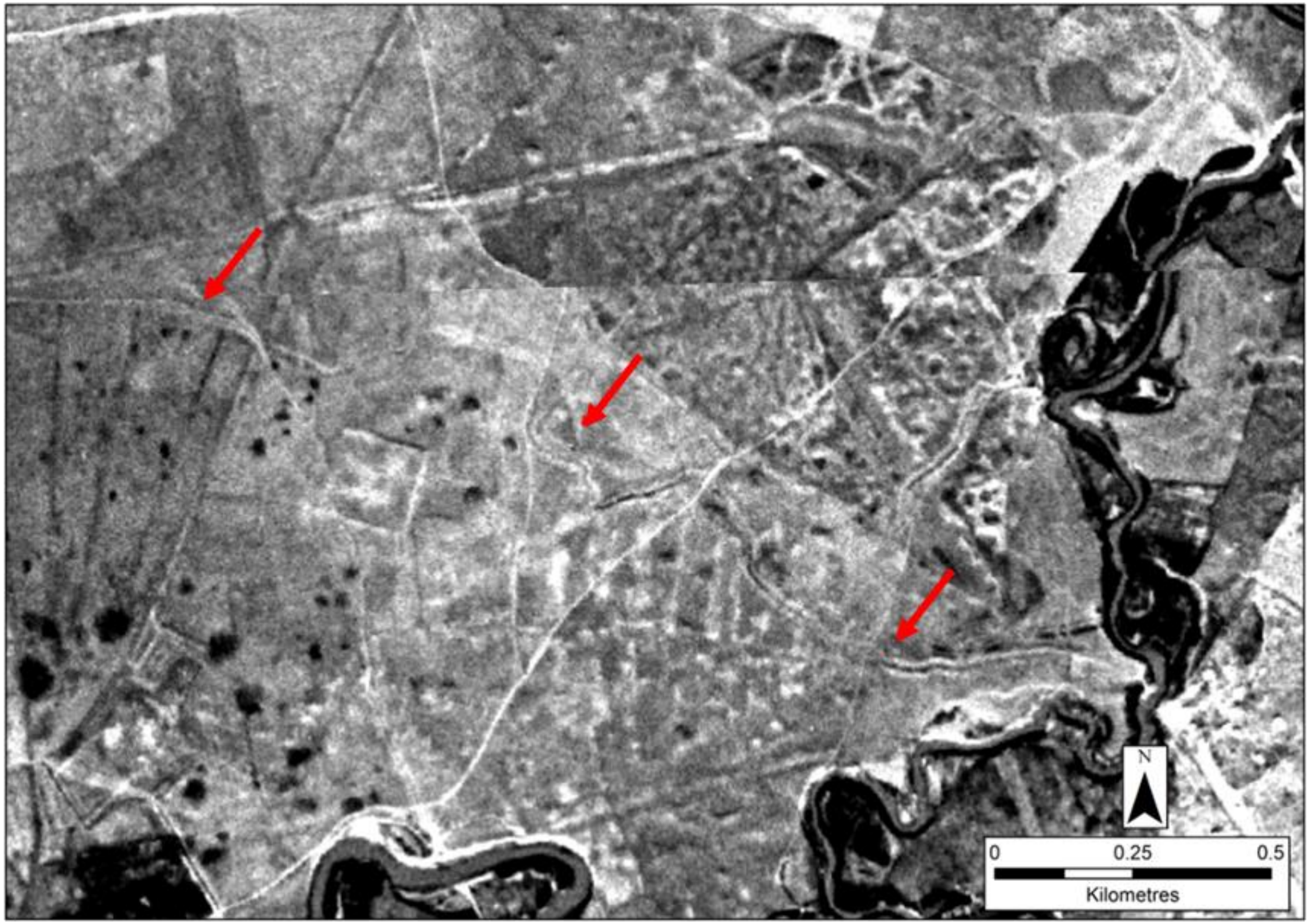


Figure 7-17: Possible canal feature near Fort 21

Figure 7-18: Canals associated with the Gorgan Wall in the western Steppe

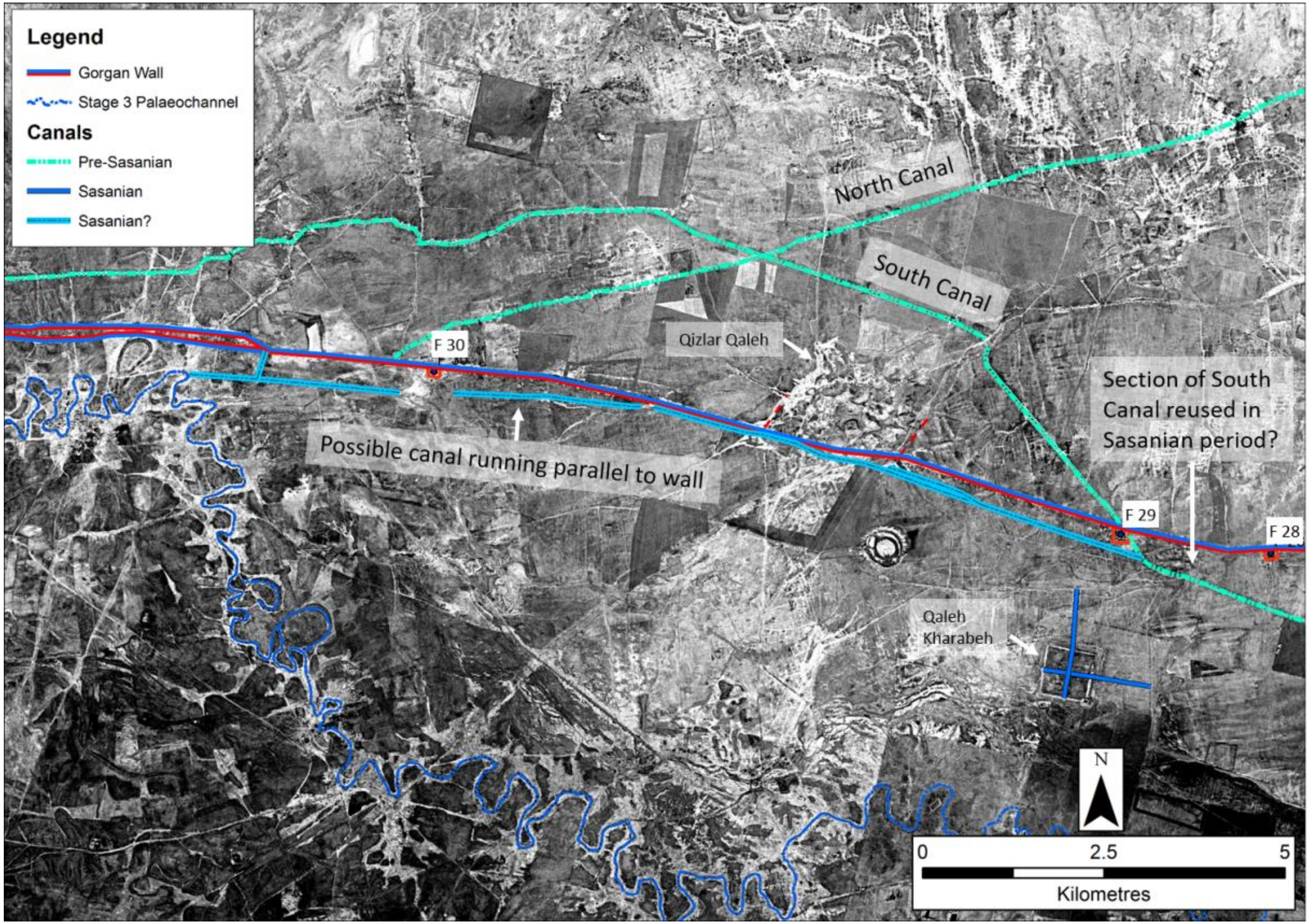


Figure 7-19: Possible Sasanian Canal features in the Western Steppe

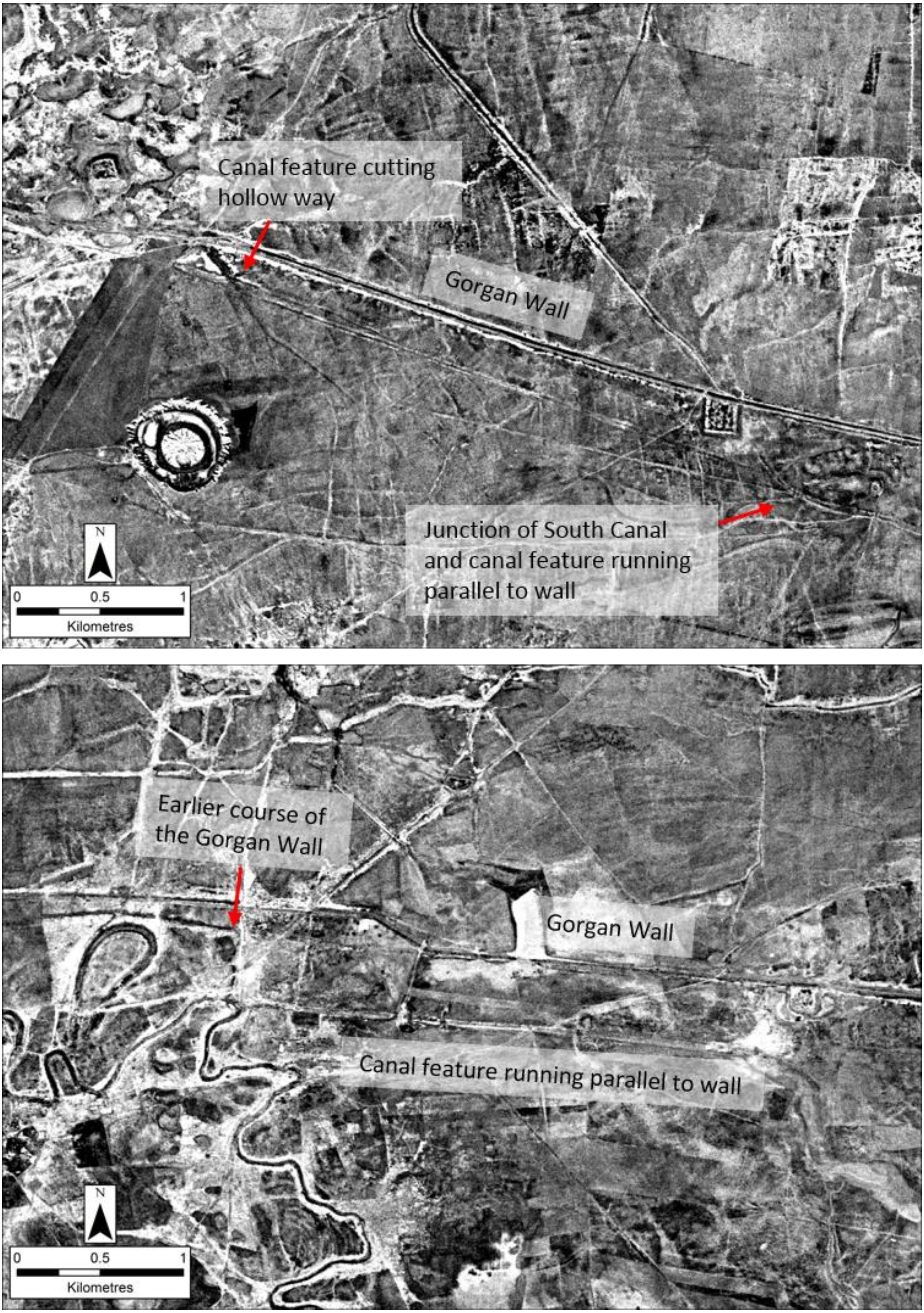


Figure 7-20: Canals in the western steppe associated with the modern course of the Gorgan River

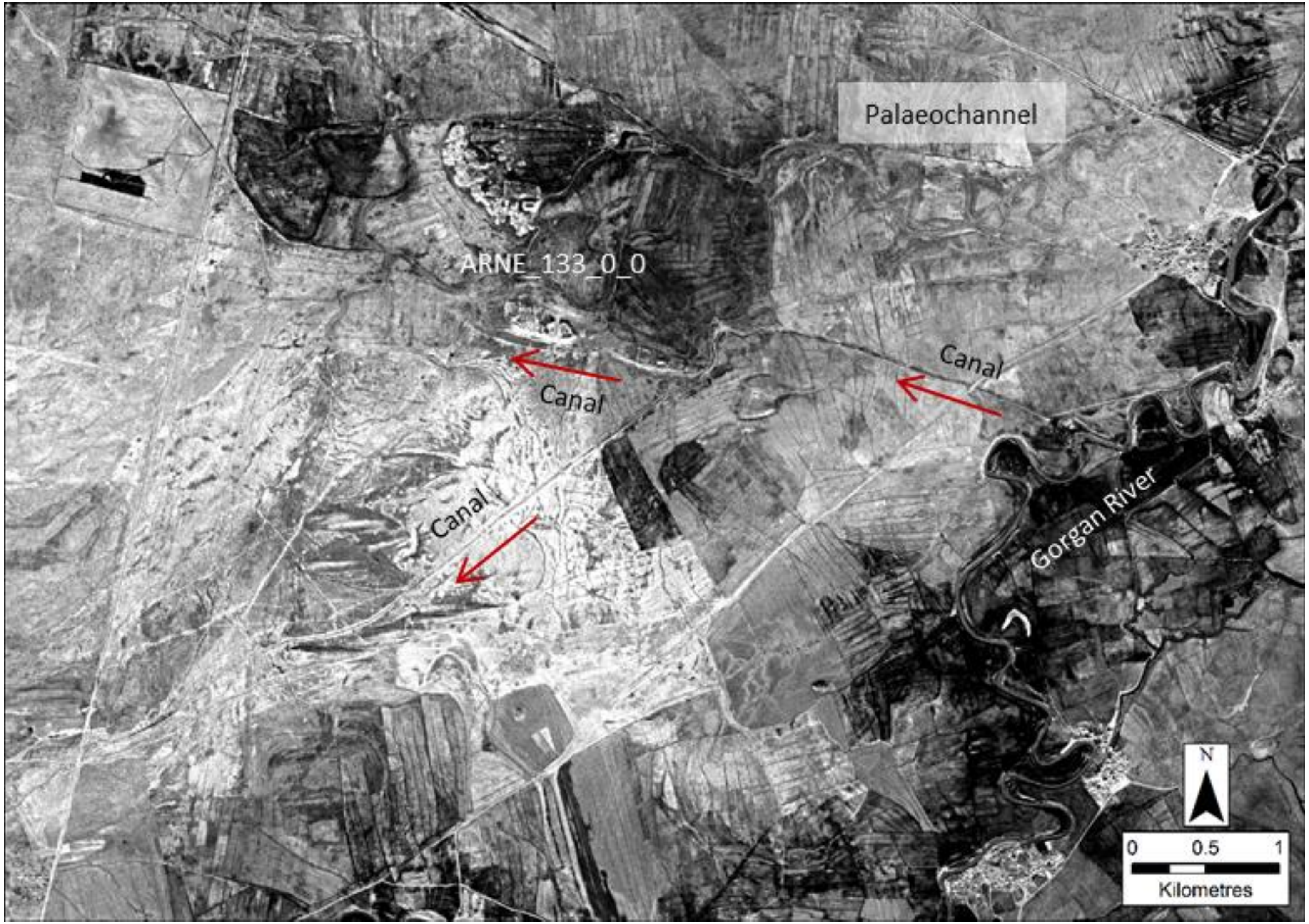
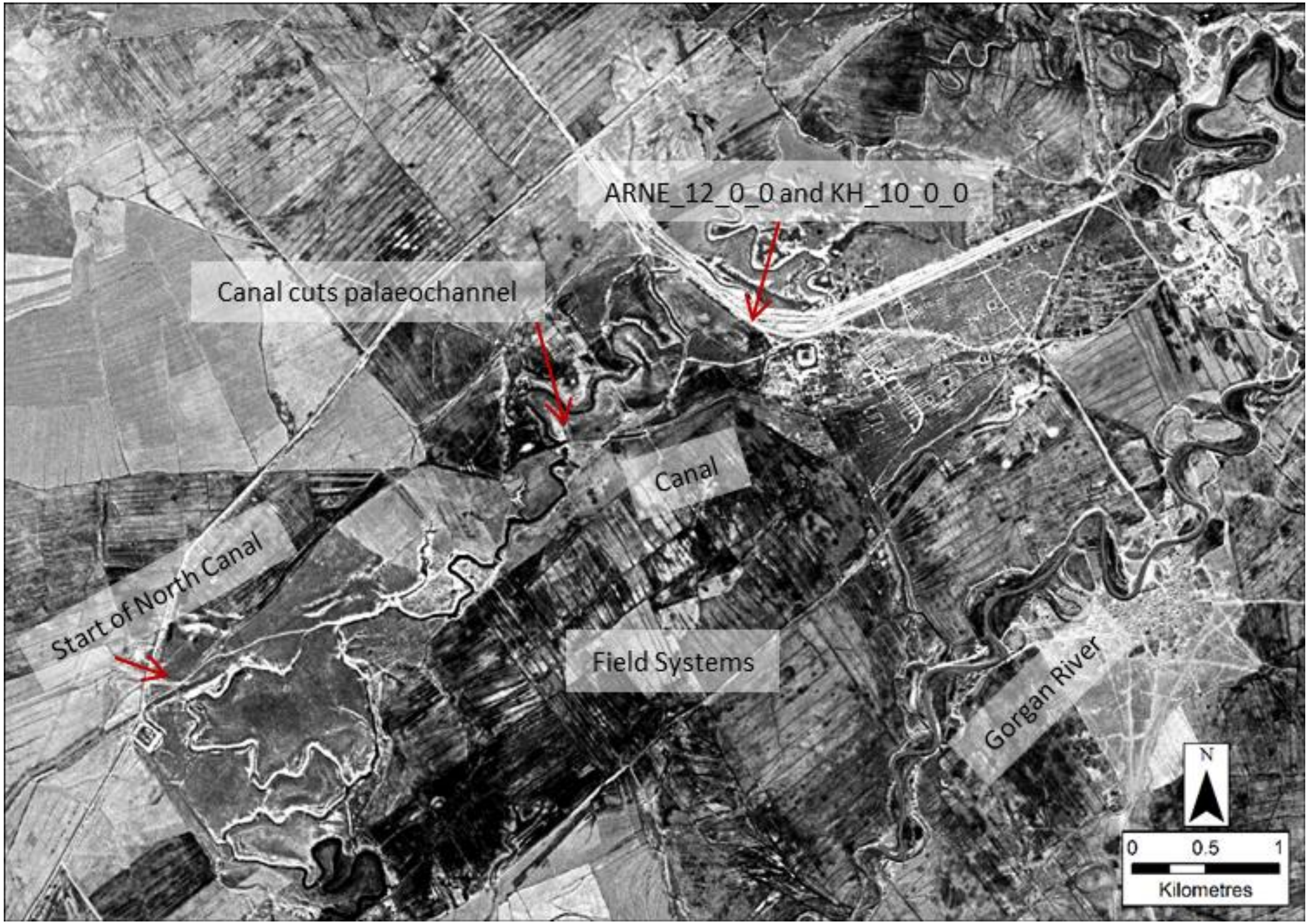


Figure 7-21: Canals in the western steppe associated with the modern course of the Gorgan River



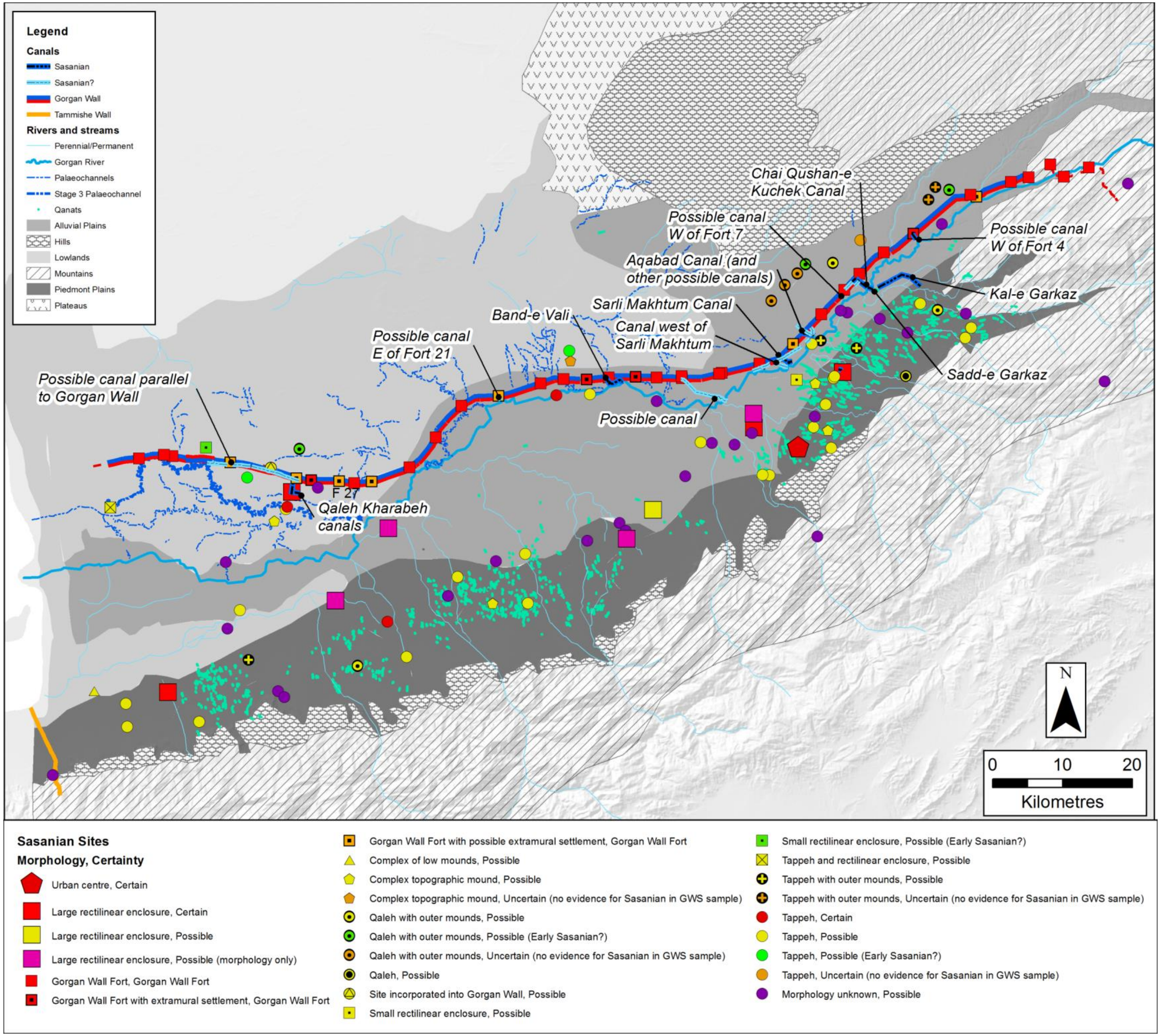


Figure 7-22: Sasanian and possible Sasanian sites in relation to geography and water management systems (qanats). Site data from Abbasi 2011; Kiani 1982b and Wilkinson et al. 2013. Data on geographical zones derived from the 'Regional Map of Land Resources and Potentialities: Gorgan Region – East Mazanderan 1968'. Base map SRTM 90m (Data available from the US Geological Survey).

Figure 7-23 A) Qanats in the vicinity of Tureng Tappeh in the 1930s (after Schmidt 1940: Plate 71 – Courtesy of the Oriental Institute of the University of Chicago). B) The same area in the 1960s on the CORONA (imagery available from the US Geological Survey).

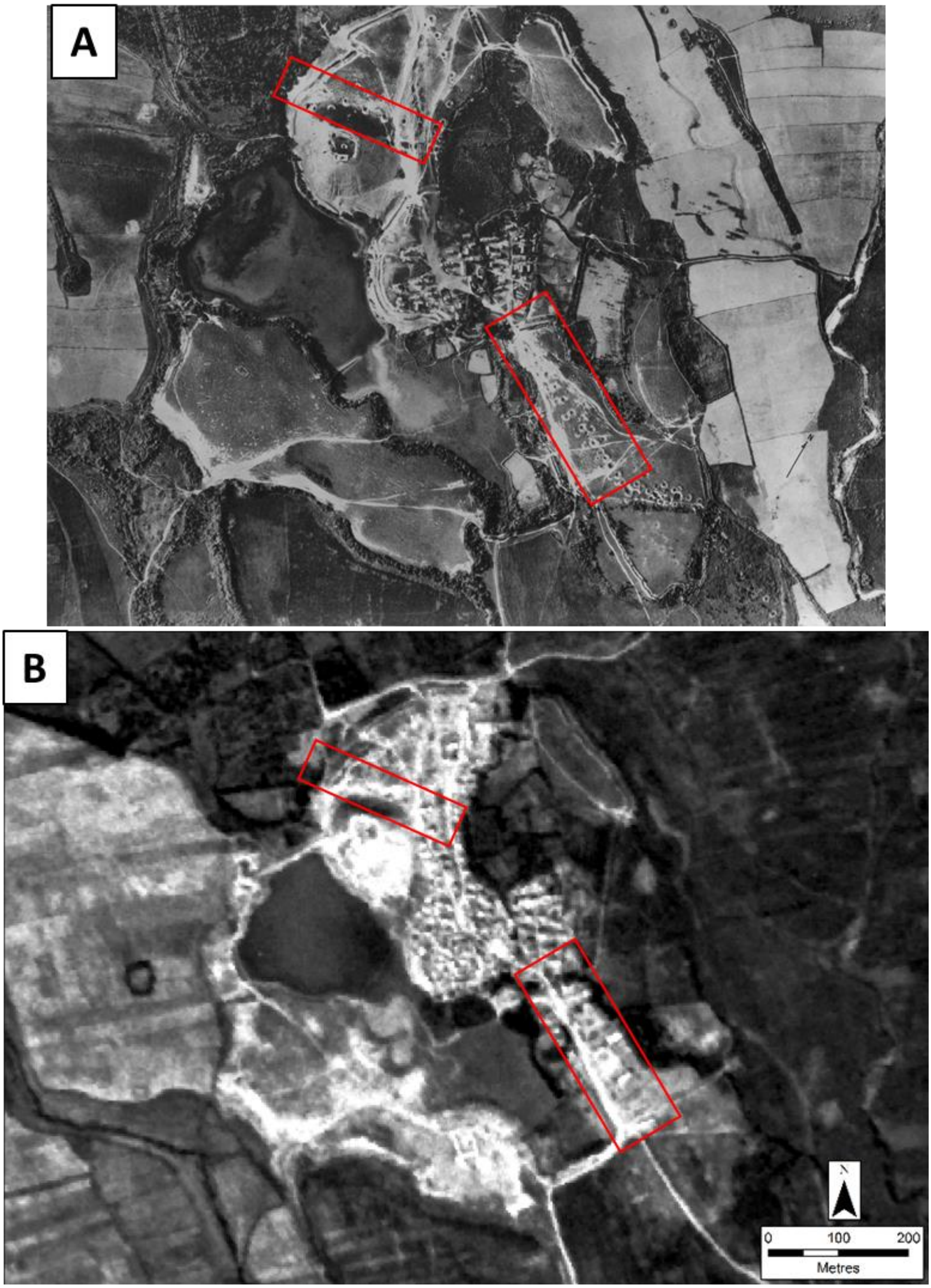


Figure 7-24: Qanats in the vicinity of Tureng Tappeh in 2016 (imagery available on Google Earth).

Figure 7-25: Example of a qanat on the Gorgan Plain as seen on the CORONA imagery. Qanats can be identified as a linear arrangement of relatively evenly spaced white dots representing the upcast mounds of the access shafts.

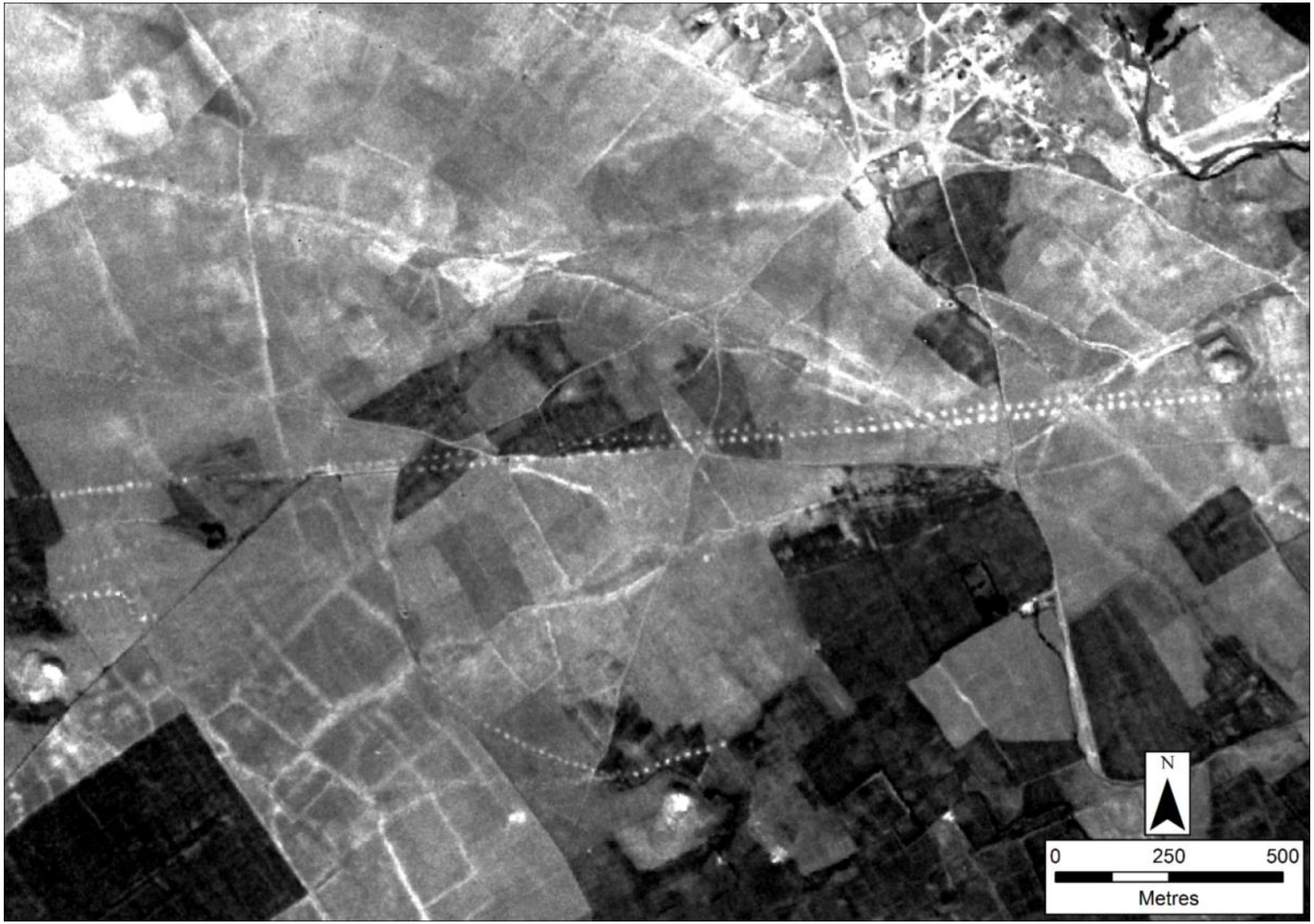


Figure 7-26: Islamic period sites in relation to geography and water management systems (qanats). Site data from Abbasi 2011; Arne 1945; Shiomi 1976, 1978; Kiani 1982b and Wilkinson et al. 2013. Data on geographical zones derived from the 'Regional Map of Land Resources and Potentialities: Gorgan Region – East Mazanderan 1968'. Base map SRTM 90m (Data available from the US Geological Survey).

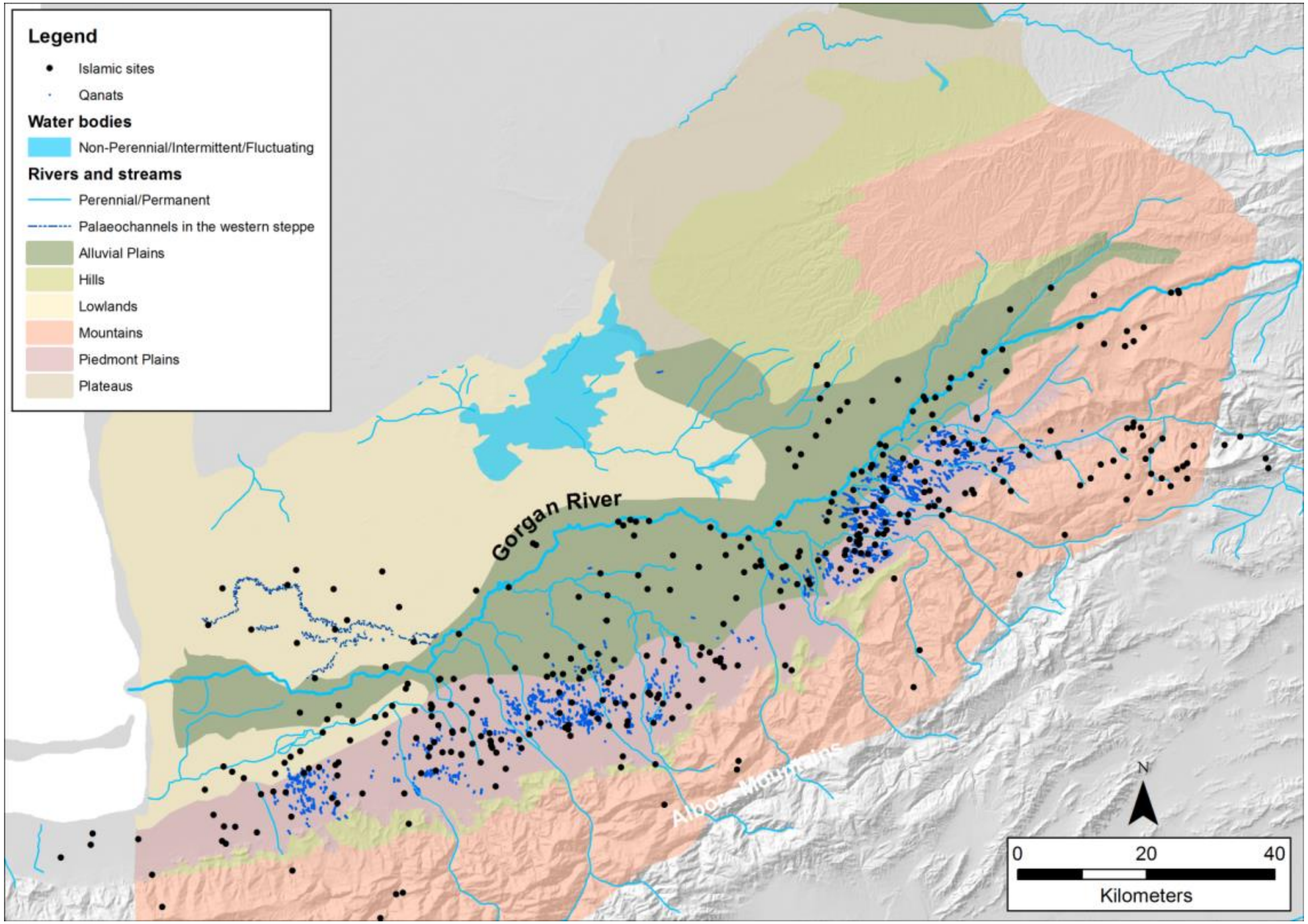


Figure 7-27: Regions mentioned in the text. Base map 90m SRTM DEM.

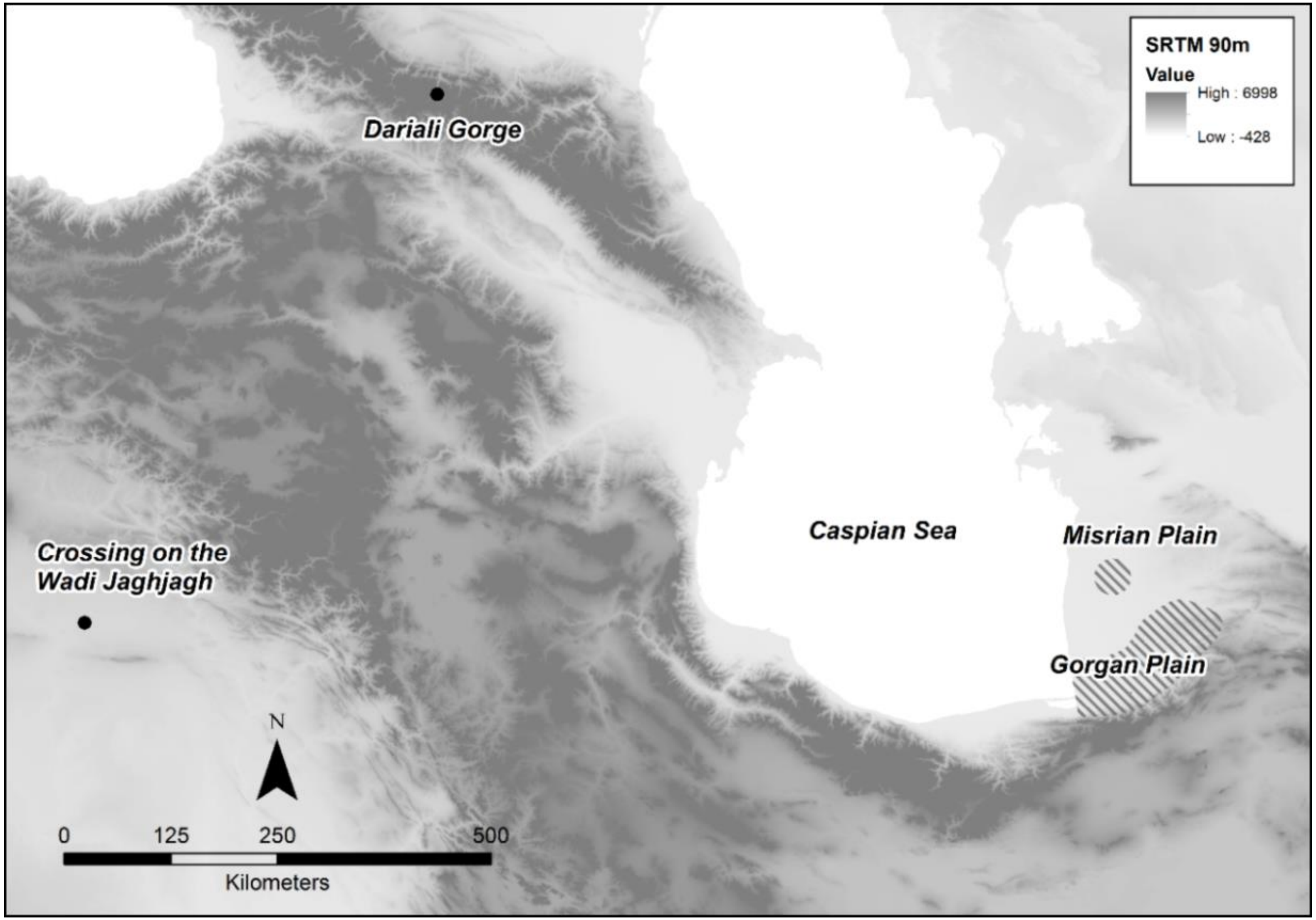


Figure 7-28: Map of the Gorgan Plain showing the Gorgan Wall and archaeological sites Mapped on CORONA Imagery. Sites and features mentioned in the text are marked.

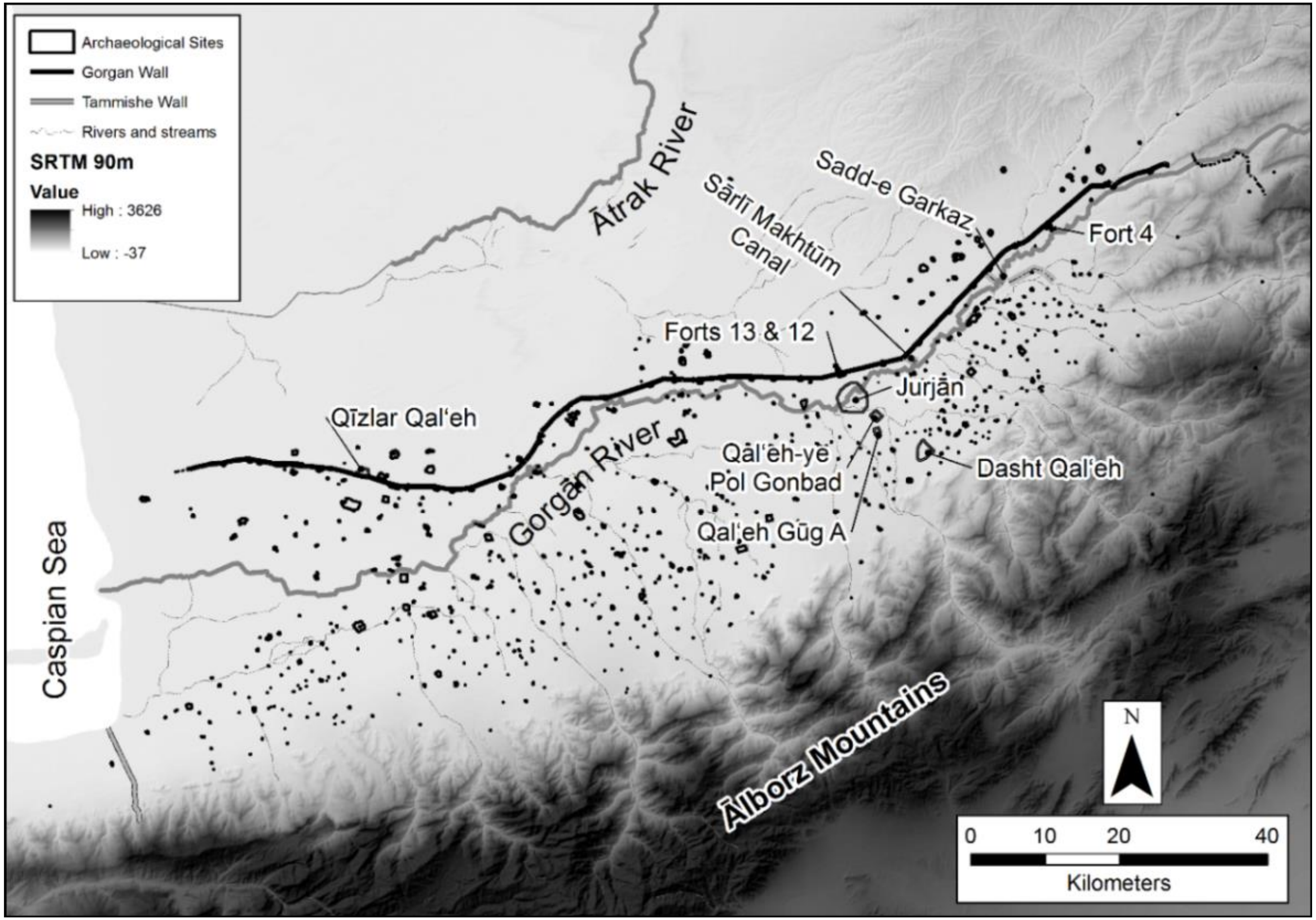


Figure 7-29: Possible Crossing points of the Gorgan Wall. The Sarli Makhtum canaL flowing through a gap in the wall into the ditch on its norther side (left), Qizlar Qal'eh an earlier site incorporated into the Gorgan Wall (centre), and Forts 12 and 13 on the Gorgan Wall. CORONA imagery available from the US Geological Survey.

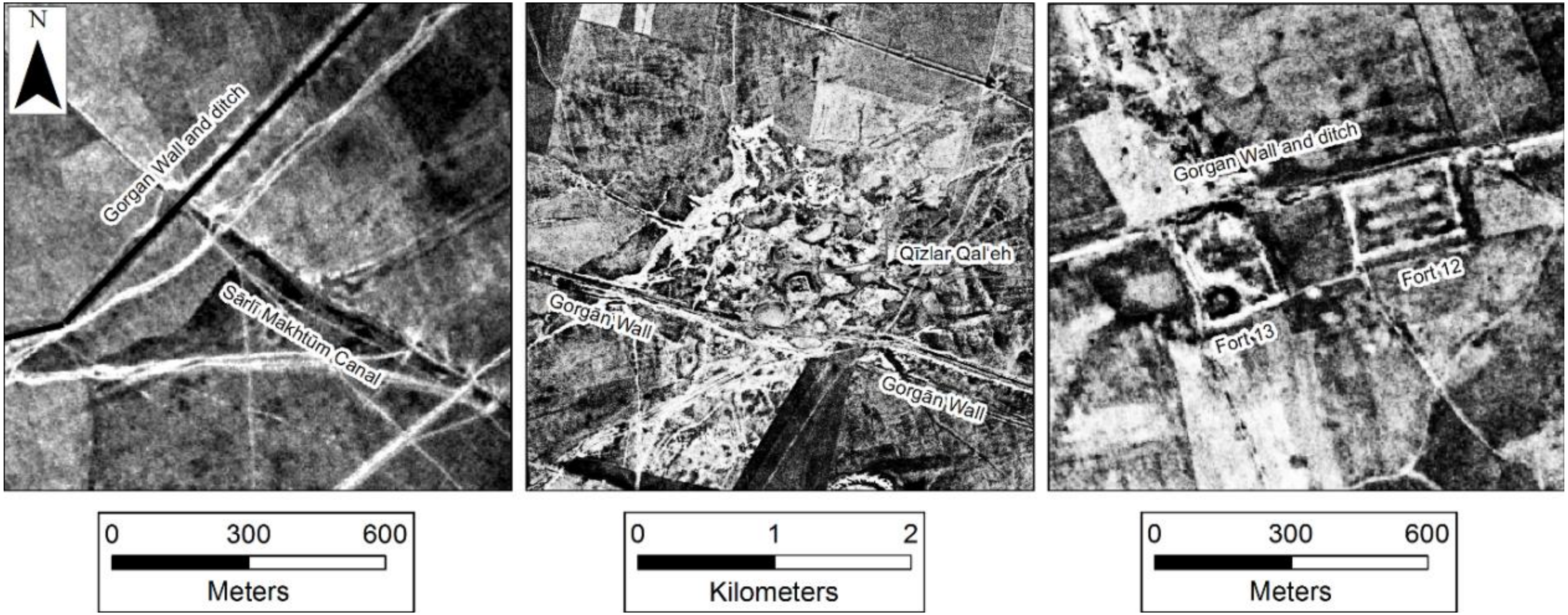


Figure 7-30: Hollow ways visible on the CORONA imagery near Forts 12 and 13. CORONA imagery available from the US Geological Survey.

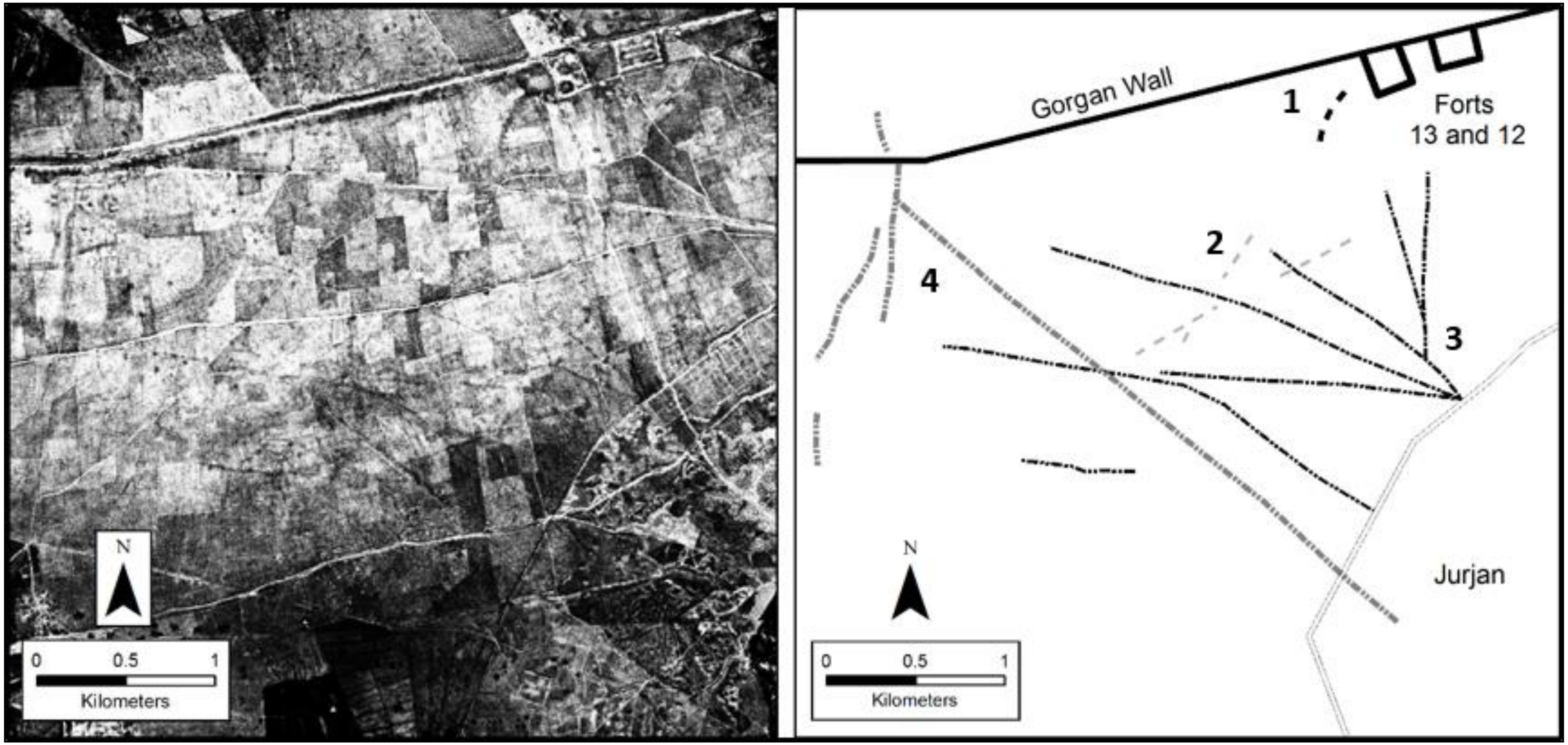


Figure 7-31: A possible Mid to Late Sasanian route system based on the alignment of forts, campaign bases, urban sites (See Sauer et al. 2013: Wilkinson et al. 2013: 102-145), and a mountain pass. Note the location of a possible Sasanian site in the pass (see Abbasi 2011: Map 13).

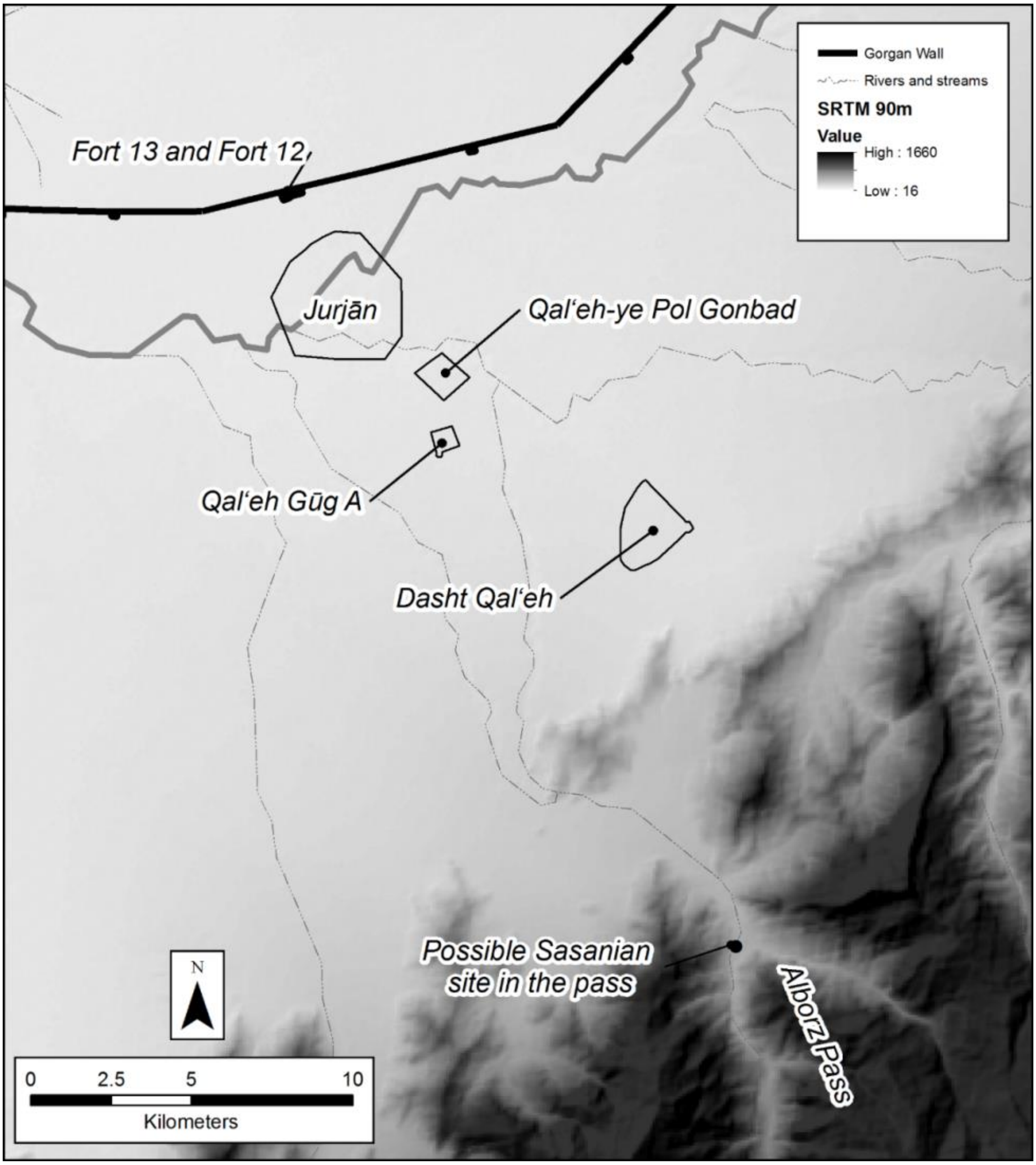
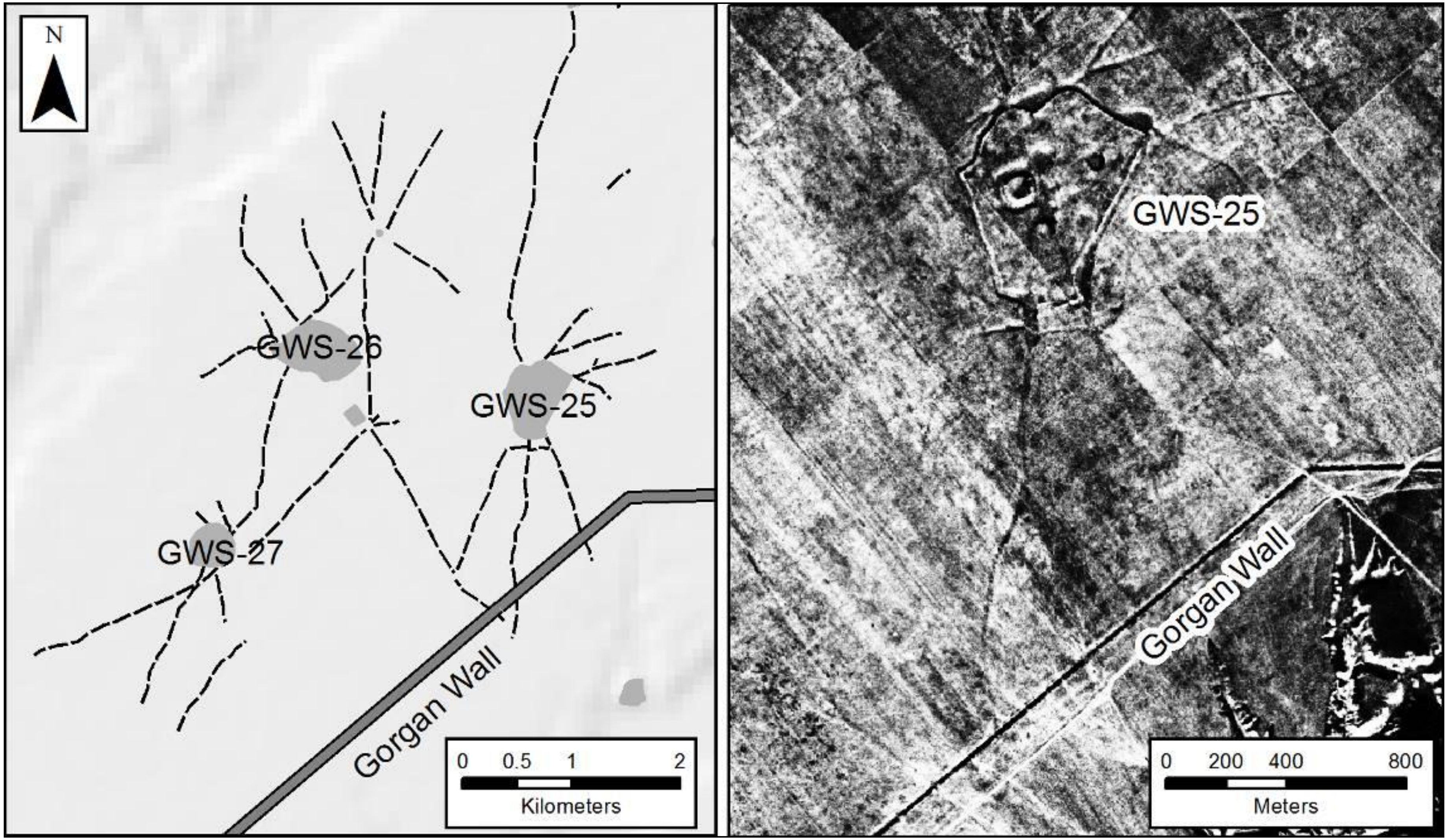


Figure 7-32: Hollow ways cut by the Gorgan Wall. Left – Base map SRTM 90m DEM Right – CORONA image (imagery available from the US Geological Survey).



8. LANDSCAPE TRANSFORMATIONS FROM THE IRON AGE TO THE LATER TERRITORIAL EMPIRES

Figure 8-1: Relationship between geographical sub-zones of the plain and long-term patterns of settlement. Kernel density illustrates areas with highest concentration of archaeological sites from all periods (red). Data on geographical zones derived from the 'Regi onal Map of Land Resources and Potentialities: Gorgan Region – East Mazanderan 1968'. Base map SRTM 90m (Data available from the US Geological Survey).

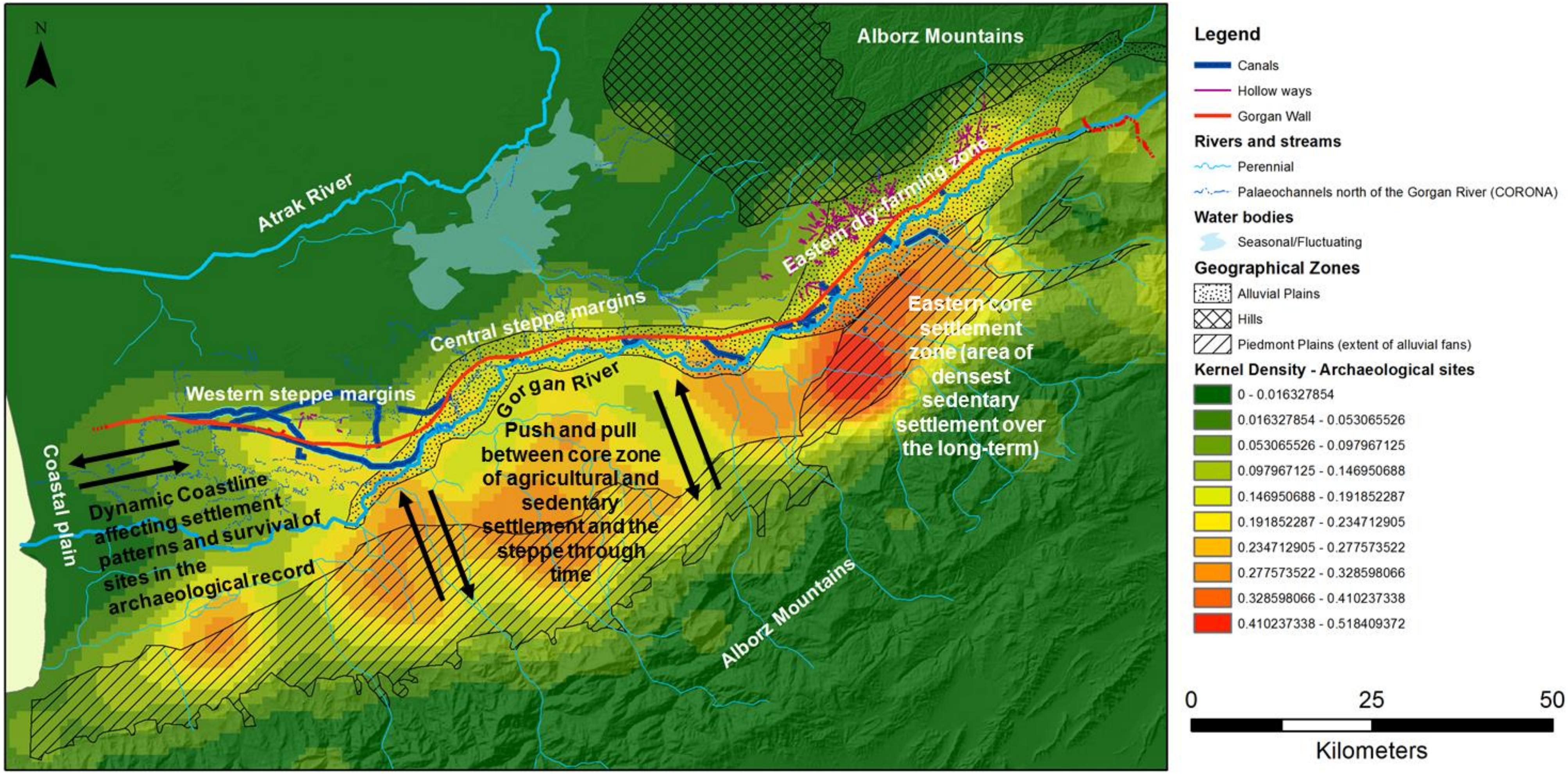


Figure 8-2: Locations of selected case studies discussed in this chapter.

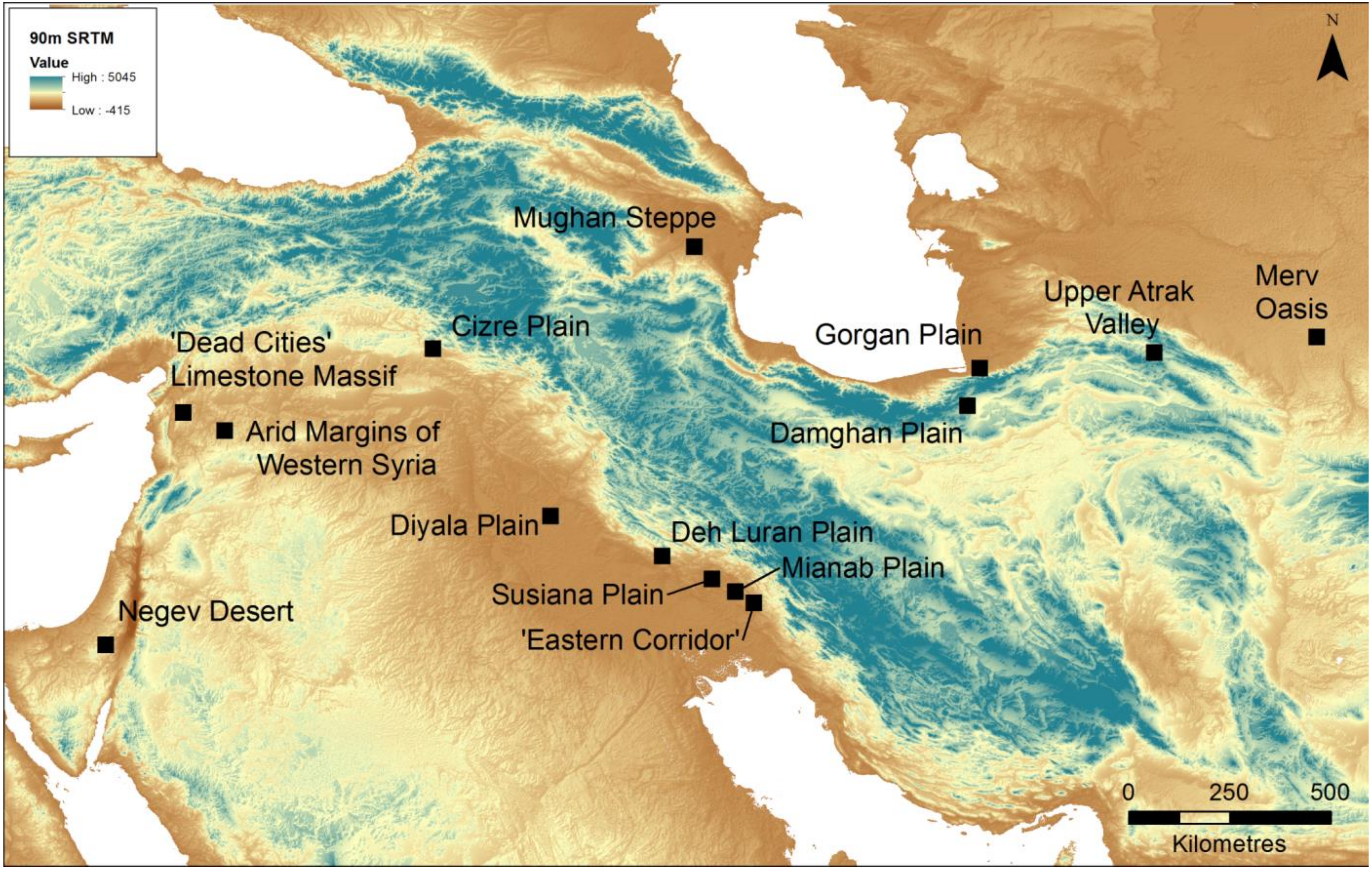


Figure 8-3: Zones of settlement and land use in the Byzantine period in the Arid Margins of Syria. After Geyer 2011 Fig. 6

Image redacted due to copyright

Table 8-1: Overview of settlement and land-use patterns from case study areas discussed in section 8.4.

EMPIRE	DATES	LOCATION	PREVIOUS SEDENTARY SETTLEMENT?	RURAL LANDSCAPE	TOWNS/URBAN CENTRES	FORTIFICATIONS	IRRIGATION	INTERACTIONS WITH MOBILE PASTORAL COMMUNITIES	ECONOMIC BASE	MECHANISMS OF EXPANSION
Neo-Assyrian	Late 10th - 7th centuries BC	Cizre Plain	Yes	Dense rural landscape. Increase in settled area and number of sites (esp. small sites)	A few large sites (towns) acting as regional imperial centres; no intermediate sized site	Establishment of forts or fortified settlements as first stage of expansion into new regions.	No	?	Rainfed cultivation; supporting growing urban populations in the Assyrian core	Imperial reorganisation of the landscape
Late Roman/ Byzantine	3rd - 8th (but possibly up to 10th/11th) centuries AD	Central Negev	Some evidence for previous settlement, but minimal landscape investment	Dense rural landscape. Diverse range of rural settlements; semi-sedentary settlement	Large villages (some with urban amenities); acted as regional centres	Fortified farms	Run-off irrigation systems	Evidence for seasonal /semi-sedentary settlements; Seasonal movement of transhumant populations	Production for local consumption and export (vine, fruit, and possibly olive); increase in pastoral activity	Local response to economic demand. Reginal elites? Private landowners?
Late Roman/ Byzantine	4th - 6th centuries AD	Arid Margins of Western Syria	Some evidence for previous settlement, but minimal landscape investment	Dense rural landscape	Village of Andarin; urban amenities but not administrative status	Forts?	Qanat irrigation	Farms for animal husbandry in Zone III (and Zone IV but to a less extent); Zone V is domain of nomadic groups with some semi-sedentary activity	Zones 1 to 5 representing decreasing reliance on agriculture and corresponding reliance on pastoralism; integrated agropastoral system	Local response to economic demand. Reginal elites? Private landowners?
Late Roman/ Byzantine	4th - 6th centuries AD (but somewhat earlier and continuing into the 9th century)	Limestone Massif - Dead Cities and Orontes River Valley	Minimal	Dense rural landscape	Urban centres in larger region (Orontes River Valley); Limestone massif mainly villages (some with urban amenities	No	No	?	Production for local consumption and export (vine, olive);	Local response to economic demand. Reginal elites? Private landowners?
Sasanian	3rd - 7th centuries AD	Merv and the Merv Oasis	Yes	Increase in site number, particularly small sites (less than 4 ha)	Merv; two other sites over 30 ha; some towns	Merv; Small forts and fortified sites	Maintenance and extension of existing irrigation systems	Possible activity beyond the oasis represented by pottery scatters? Interactions with mobile communities?	Irrigation agriculture (grains, fruits (including trees), legumes; cotton; Animal husbandry (sheep/goat, cattle pig and wild animals)	Imperial or elite investment resulting in reorganisation of the landscape?
Sasanian	5th-6th centuries AD	Mughan Steppe	Some evidence for previous settlement, but minimal landscape investment	Fortified farms with extramural settlement	Ultan Qalasi	Ultan Qalasi; fortified farms	Canal irrigation	? But large areas of grazing land; possible settlement of formally nomadic communities	Irrigation agriculture	Imperial reorganisation of the landscape
Late Iron Age through Early Sasanian?	c. 8-6th century BC to Parthian/Early Sasanian (?)	Steppe margins of the Gorgan Plain	Some evidence for previous settlement, but minimal landscape investment	Complex sprawling sites (central mound/qal'eh surrounded by outer mounds); minimal evidence for small rural sites	?	Some of the steppe sites (e,g Qelich Qoineq , GWS_5, or GWS_25) are walled	Irrigation canals in the western steppe	Western steppe sites acting as centres for interactions between mobile pastoral and agricultural communities? At least village based herding in the eastern dry farming zone evidenced by hollow ways	Mixed agropastoral strategy? Irrigation agriculture?	Local response to economic demand? Imperial interest, but not top down reorganisation? Regional elites?
Mid to Late Sasanian	4th - 6th centuries AD	Gorgan Plain	Southern plain densely occupied Limited evidence for settlement in the steppe margins in this period	Decrease in site numbers as a result of centralisation? Or just poor settlement record? If the latter, dense rural landscape?	Dasht Qal'eh as main urban centre; towns? Urban growth at expense of rural landscape?	Fortlets, forts, campaign bases and fortified city; Gorgan Wall and associated irrigation systems	Qanats?	Militaristic and political - Hephthalites and other 'nomadic' groups are catalysts for the building the Gorgan Wall; also local interaction with pastoral groups – trade etc.?	Agriculture (rain-fed? Irrigated?) to support local populations (rural, urban, military); production of surplus for export? Short-distance herding?	Imperial or elite investment resulting in reorganisation of the landscape?

APPENDIX – DATA SOURCES AND TYPES IN THE DATABASE

Table A. Data sources used in the database.

DATA SOURCE	DEFINITION
GWP Survey	Data from Wilkinson et al. 2013
Kiani Survey	Data from Kiani 1982b, 1984
Arne Survey	Data from Arne 1945
Japanese Survey	Data from Shiomi 1976, 1978
Narges Tepe Survey	Data from Abbasi 2011
C1056	CORONA KH-4A mission 1052
KH7	GAMBIT KH-7 mission
GWP Excavations	Data from Sauer et al. 2013
Excavations (archive)	Data from any previous excavations

Table B. Data category and definitions. Adapted from the FCP Database (after Lawrence 2012: Appendix 2, with modifications)

DATA CATEGORY	DEFINITION
Current Landcover	Observed physical cover on the earth's surface (FAO definition). Current is defined as when the record was made
Current Landuse	Observed utilisation of spatial unit when the observation was made
Geomorphological Context	Geomorphological Context
GIS Modification	Record to indicate that a change has been made in the GIS. Recorded to retain data change
Interpretation	Thoughts we have about the attributes of the spatial unit i.e. How sure we are about the archaeological significance/boundary/archaeological function
Literature Reference	Indication that the spatial unit has been described or mentioned in a written source
Map Feature	Spatial unit appears on map/legend as distinctive feature
Non-Site	Indicates that the unit has been assessed as having no archaeological relevance
Object Data	Records associated with any type of artefactual data i.e. pottery
Off Site Feature	Information about an archaeological entity recorded off-site i.e. Aan installation on the side of the road
Site Feature	Information about an archaeological entity recorded at a site
Site Morphology	Description of the physical attributes of a site i.e. Shape and size
Survey Methodology	Records the ways in which the site has been surveyed (both in the field and desk based)

Table C. Unique data types (Category: Data Type) and definitions used in the database. Adapted from the FCP Database (after Lawrence 2012: Appendix 2, with modifications and additions)

UNIQUE DATA TYPE	GLOSSARY
Current Landcover : Bare Tepe	Tepe (tappeh) with limited/no vegetation cover
Current Landcover : Low Scrub	Low cover of wild vegetation
Current Landcover : Water Body	Lake, pond, river, wadi
Current Landcover: Forested	Covered by forest
Current Landuse : Arable	Unclassified cereal cultivation
Current Landuse : Buildings (Modern)	Modern buildings
Current Landuse : Dam	Dam
Current Landuse : Dry Arable	Dry farming cereal cultivation
Current Landuse : Fallow	Formerly cultivated land
Current Landuse : Fruit/Olive Grove	Fruit or Olive Trees
Current Landuse : General Agricultural Use	Unspecified agricultural use
Current Landuse : Grazing (Unclassified)	Unspecified land for animals
Current Landuse : Horticulture	Gardens: Legumes and other vegetables, small holdings
Current Landuse : Military Use	Military Base or installation
Current Landuse : Modern Graves	Modern burial area
Current Landuse : Modern Settlement	Modern buildings currently used for occupation. I.e. An occupied Village
Current Landuse : Modern Structure(s)	Modern buildings which may or may not be occupied by people
Current Landuse : Orchard (Unspecified)	Cultivated edible tree crops
Current Landuse : Rough Grazing	Rough scrub land for animals
Current Landuse : Tree Plantation (non-edible)	Cultivated non-edible tree crops e.g. Conifer, Eucalyptus
Current Landuse : Unploughed	Formerly cultivated land not currently ploughed
Geomorphological Context : Alluvial Fan	Fanned alluvial deposits from river/wadi
Geomorphological Context : Alluvial Plain	Plain of alluvial deposits
Geomorphological Context : Alluvium	Alluvial sediment
Geomorphological Context : Bluffs	Steep headland
Geomorphological Context : Cliff Top	Cliff top
Geomorphological Context : Comments	Comments on the Geomorphology
Geomorphological Context : Degrading Outcrop	Eroding/weathered stone outcrops
Geomorphological Context : Flat (Topography)	Flat ground
Geomorphological Context : Flood Plain	Flood plain of river/wadi
Geomorphological Context : High Spur	High promontory of land
Geomorphological Context : Hill	Slopes of bounded rise (i.e. Hill)
Geomorphological Context : Hilltop	Summit of bounded rise (i.e. Hilltop)
Geomorphological Context : Lake Edge	Next to lake
Geomorphological Context : Low Rise	Slightly raised area in relation to surrounding landscape
Geomorphological Context : Low Spur	Low promontory of land
Geomorphological Context : Lower	Lower slope of raised area (inc. Hill, ridge etc.)

UNIQUE DATA TYPE	GLOSSARY
Slope	
Geomorphological Context : Middle Slope	Middle slope of raised area (inc. Hill, ridge etc.)
Geomorphological Context : Plain (Unclassified)	Open fairly flat relatively smooth land. No further details.
Geomorphological Context : Plateau	High tabular plain (i.e. Like a table-top)
Geomorphological Context : Ridge	Elongated raised area
Geomorphological Context : River Terrace	Step of land formerly adjacent to river. Relic of former flood plain.
Geomorphological context: River Bed (Ancient)	Land within a former river bed.
Geomorphological Context : Slope	Land with demonstrable gradient
Geomorphological Context : Spur (Unclassified)	Promontory of land. No further details
Geomorphological Context : Swales	Low-lying land between ridges
Geomorphological Context : Terrace	Step of land adjacent. Unknown origin.
Geomorphological Context : Upland	Large area of raised land
Geomorphological Context : Upper Slope	Upper slope of raised area (inc. Hill, ridge etc.)
Geomorphological Context : Valley (Unclassified)	Elongated depression which may or may not contain a water source (ie. River, spring, wadi). No further details
Geomorphological Context : Valley Bottom	Flat area at base of Valley
Geomorphological Context : Wadi Bottom/Banks	Channel and adjacent banks of wadi
Geomorphological Context : Wadi Fan	Fanned deposits from wadi
Geomorphological Context : Wadi Terrace	Step of land formerly adjacent to wadi. Relic of former flood plain.
GIS Modification : Comments	Comments on any GIS Modification which has been made to spatial unit corresponding to given Major ID
GIS Modification : Desk Based Assessment	Record to indicate that an assessment has been made concerning the GIS Modification
GIS Modification : Error	Records that there is an error with the spatial GIS unit corresponding to the given Major ID
Interpretation : Archaeological Significance	Level of confidence that the spatial unit is of archaeological interest (i.e. Not modern of natural). Definite, High, Medium, Low, Negligible, Non-Site
Interpretation : Boundary Certainty	Level of confidence that the GIS polygon reflects the intended boundary of the spatial unit. Definite, High, Medium, Low, Negligible
Interpretation : Geographical Precision	Level of confidence that the GIS polygon reflects the intended location of the spatial unit. Definite, High, Medium, Low, Negligible
Interpretation : No Supporting Evidence	Record to show changed (downgrading to non-site) interpretation based on further investigation
Interpretation : Overall Site Certainty	Overall level of confidence reflecting a combination of boundary certainty, geographical precision and archaeological significance. Definite, High, Medium, Low,

UNIQUE DATA TYPE	GLOSSARY
	Negligible
Literature Reference : Literature	Unspecified publication, normally field report but could include grey literature
Literature Reference : Original Survey ID	Recorded survey ID from original literature or fieldwork
Literature Reference : Other Placename	Placename from literature not including categories below
Literature Reference : Place Name (Translation)	Translation (transliteration) of placename from other language from literature
Literature Reference : Qaleh Placename	Placename containing 'Qaleh' from literature
Literature Reference : Tepe Placename	Placename containing 'Tepe' or 'Tappeh' from literature
Map Feature : Antiquity Symbol	Antiquity Symbol on map
Map Feature : Contour	Contour lines on map suggest archaeological feature (e.g. Small rounded mound may be a tepe/tappeh)
Map Feature : Enclosure(s)	Stone enclosures drawn on map. Often recording Irregular Clustered Structures
Map Feature : Hydrological Feature	Ancient or modern features related to water recorded on map. E.g. Canals. Dams, Irrigation features
Map Feature : Map Feature	Feature drawn/depicted on map interpreted as of interest e.g. Field systems
Map Feature : Other Placename	Placename from map not including categories below
Map Feature : Place Name (Translation)	Translation (transliteration) of placename from other language from map
Map Feature : Qalah Placename	Placename containing 'Qaleh' from map
Map Feature : Tepe Placename	Placename containing 'Tepe' or 'Tappeh' from map
Non-Site : Animal Pens	Modern/Recent enclosures used for animals
Non-Site : Background Landscape (Test)	Abstract area chosen for SHR background sample survey
Non-Site : Natural Feature	Landscape feature identified as possibly archaeological but determined to be natural in origin. E.g. Stone outcrop
Non-Site : Settlement	Modern settlement
Non-Site : Unclassified	Feature defined at some point as of interest but now reclassified
Object Data : Animal Bones	Animal Bones (pre-modern)
Object Data : Bone (Initial Counts)	Uncategorised bone (Initial counts prior to specialist analysis)
Object Data : Chipped Stone	Chipped stone (lithics)
Object Data : Chipped Stone (Diagnostic)	Chipped stone (lithics) (diagnostic)
Object Data : Chipped Stone (Initial Counts)	Chipped Stone (lithics) (Initial counts prior to specialist analysis)
Object Data : Coins	Coins (pre-modern)
Object Data : Conglomerate (Initial Counts)	Conglomerate stone present, no further details (Initial counts prior to specialist analysis)
Object Data : Diagnostic (Reclassified)	Unclassified artefact where date has been reassessed
Object Data : Diagnostic (UNCERTAIN)	Possibly dated unclassified artefact
Object Data : Diagnostic (Unclassified)	Dated unclassified artefact
Object Data : Figurine	Figurine
Object Data : Glass	Glass
Object Data : Glass (Diagnostic)	Dated glass

UNIQUE DATA TYPE	GLOSSARY
Object Data : Glass (Initial Counts)	Glass (Initial counts prior to specialist analysis)
Object Data : Human Bones	Human Bones (Pre-modern)
Object Data : Kiln Slag	Waste material from kiln
Object Data : Limestone (Initial Counts)	Limestone (Initial counts prior to specialist analysis)
Object Data : Metal	Metal artefact
Object Data : Metal (Initial Counts)	Metal artefact (Initial counts prior to specialist analysis)
Object Data : Non-Pottery Finds	Non-pottery artefacts (no further details)
Object Data : Object Comment(s)	Comments on object data at a given location
Object Data : Petrographic Samples	Petrographic Sample from pottery taken
Object Data : Photograph (Finds - Lab)	Artefact photographs post-field visit
Object Data : Photograph (Finds - Petrography)	Artefact photographs petrography record
Object Data : Pipe (Diagnostic)	Dated smoking pipe
Object Data : Pipe (Initial Counts)	Smoking Pipe (Initial counts prior to specialist analysis)
Object Data : Pottery	Pottery present
Object Data : Pottery (Diagnostic)	Dated pottery
Object Data : Pottery (Initial Counts)	Pottery (Initial counts prior to specialist analysis)
Object Data : Sherd Diagrams	Object Drawn, should always have file attached unless lost/corrupted
Object Data : Slag (Initial Counts)	Waste material from material processing (glass, metal, lime etc)
Object Data : Tesserae	Mosaic fragment
Object Data : Tile	Ceramic Tile (floor, roof etc)
Object Data : Tile (Initial Counts)	Ceramic Tile (Initial counts prior to specialist analysis)
Object Data : Worked Stone (Unclassified)	Modified stone artefacts including dressed stone, basins etc
Object Data: Brick	Brick present
Off Site Feature : Altar(s)	Altar not associated with a site
Off Site Feature : Architectural fragment(s)	Fragments of building/structure not associated with a site
Off Site Feature : Cairn(s)	Stone mound (burial/non-burial/clearance) not associated with a site
Off Site Feature : Channel	Anthropogenically constructed/altered linear water feature not associated with a site
Off Site Feature : Cistern(s)	Anthropogenically constructed/altered water storage not associated with a site
Off Site Feature : Column(s) (Unclassified)	Column (Unclassified Style) not associated with a site
Off Site Feature : Dam	Anthropogenically constructed water constraining feature not associated with a site
Off Site Feature : Field System	Complex of field boundaries forming coherent and discrete unit not associated with a site
Off Site Feature : Field Wall(s)	Field boundaries not forming a coherent and discrete unit not associated with a site
Off Site Feature : Hydrological Feature	Ancient or modern features related to water E.g. Canals. Dams, Irrigation features not associated with a site
Off Site Feature : Inscription	Inscribed stone artefact not associated with a site

UNIQUE DATA TYPE	GLOSSARY
Off Site Feature : Irregular Feature	Unidentified irregular feature (not natural)
Off Site Feature : Qanat(s)	Linear arrangement of access shafts denoted by upcast mounds indicating an underground water tunnel
Off Site Feature : Quarry	Area of material extraction e.g. Stone, not associated with a site
Off Site Feature : Quern/Grindstone	Worked stone used for grinding/processing of plant remains not associated with a site
Off Site Feature : Rectangular/Square Enclosure	Rectangular/Square enclosure not associated with a site
Off Site Feature : Road(s) or Track(s) (Archaeological)	Ancient routeway including roads and hollow ways not associated with a site
Off Site Feature : Sculpture	Modified stone depiction not associated with a site
Off Site Feature : Section	Vertical exposure (archaeological and non-archaeological horizons) not associated with a site
Off Site Feature : Stele(ae)	Modified stone slab, usually commemorative not associated with a site
Off Site Feature : Tomb (Unclassified)	Burial structure (unknown style) not associated with a site
Off Site Feature : Unclassified	Unknown Installation not associated with a site
Off Site Feature : Well	Shaft from surface to water source not associated with a site
Site Feature : Agricultural Installation	Feature associated with unspecified agricultural processes associated with a site
Site Feature : Altar(s)	Altar associated with a site
Site Feature : Architectural fragment(s)	Fragments of building/structure associated with a site
Site Feature : Burial: Cemetery	Designated area/group of burials
Site Feature : Burial: Structure (non-cairn)	Above ground built burial feature (not including cairns) e.g. Mausoleum
Site Feature : Cairn(s)	Stone mound (burial/non-burial/clearance) associated with a site
Site Feature : Cave	Natural and anthropogenically modified recesses in rock
Site Feature : Channel	Anthropogenically constructed/altered linear water feature associated with a site
Site Feature: Circular features (honeycomb)	Small circular features clustered together in a honeycomb pattern
Site Feature : Citadel	Upper raised area of a site, often fortified
Site Feature : Cistern(s)	Anthropogenically constructed/altered water storage associated with a site
Site Feature : Column(s)	Column associated with a site
Site Feature : Comments	General comments on site features
Site Feature : Complex of Low Mounds	Group of low mounds considered to form part of the same site
Site Feature : Complex Topographic Mound	Mound with multiple distinct topographic areas
Site Feature : Dam	Anthropogenically constructed water constraining feature associated with a site
Site Feature : Depression	Concave feature, multiple possible causes e.g. Collapsed cisterns, extraction pits etc

UNIQUE DATA TYPE	GLOSSARY
Site Feature : Earthwork	Feature constructed from piled earth/mud
Site Feature : Enclosure Wall	Wall delineating the boundary of an enclosure
Site Feature : Enclosure(s)	Individual/Group of discrete built units interpreted as enclosures which have not been further classified i.e. Into Rectilinear vs. Circular/sub-circular.
Site Feature : External Ditch	Ditch surrounding spatial unit
Site Feature : External Paving	Area of flat stones surrounding spatial unit
Site Feature : External Revetment	Stones/wall defining edge of spatial unit
Site Feature : Field System	Complex of field boundaries forming coherent and discrete unit associated with a site
Site Feature : Field Wall(s)	Field boundaries forming a coherent and discrete unit associated with a site
Site Feature: Fort	Square or rectangular fortified unit, can contain internal features (i.e. Barrack blocks)
Site Feature : Hydrological Feature	Ancient or modern features related to water E.g. Canals. Dams, Irrigation features associated with a site
Site Feature : Inscription	Inscribed stone artefact associated with a site
Site Feature : Irregular / subcircular group of structures	Irregular / subcircular group of structures
Site Feature : Irregular / subcircular single structure	Irregular / subcircular single structure
Site Feature : Irregular Feature	Irregular feature with no other classification
Site Feature : Kiln(s)	Kiln(s)
Site Feature : Large Circular Enclosure(s)	Large Circular Enclosure(s)
Site Feature : Linear Arrangement	Linear arrangement of features
Site Feature : Lower Town	Associated area of activity/occupation to mounded site (normally late)
Site Feature : Qaleh (Unclassified)	Mounded site with concave interior (unclassified)
Site Feature : Qaleh with outer mounds	Mounded site with concave interior surrounded by lower outer mounds
Site Feature : Qaleh with outer mounds and wall	Mounded site with concave interior surrounded by lower outer mounds and an outer wall
Site Feature : Qanat(s)	Linear arrangement of access shafts denoted by upcast mounds indicating an underground water tunnel associated with a site
Site Feature : Quarry	Area of material extraction e.g. Stone, associated with a site
Site Feature : Quern/Grindstone	Worked stone used for grinding/processing of plant remains associated with a site
Site Feature : Ramparts	Defensive earthwork
Site Feature : Rectangular/Square Enclosure	Rectangular enclosure, flat interior, no internal architecture
Site Feature : Rectilinear / Square group of structures	Rectilinear / Square group of structures
Site Feature : Rectilinear / Square single structure	Rectilinear / Square single structure
Site Feature : Road(s) or Track(s) (Archaeological)	Ancient routeway including roman roads and hollow ways associated with a site

UNIQUE DATA TYPE	GLOSSARY
Site Feature : Rubble Concentration	Mass of loose stone associated with a site
Site Feature : Scatter	Flat Concentration of artefactual material dispersed across the surface associated with a site
Site Feature : Sculpture	Modified stone depiction associated with a site
Site Feature : Section	Vertical exposure (archaeological and non-archaeological horizons) associated with a site
Site Feature : Soil Colour Difference	Variation in ground-surface colour distinct from surrounding area associated with a site
Site Feature : Standing Architecture (Archaeological)	Above ground pre-modern buildings
Site Feature : Stele(s)	Modified stone slab, usually commemorative associated with a site
Site Feature : Structural Feature(s)	Unidentified in-situ construction remains i.e. Walls, aligned blocks etc.
Site Feature : Tepe (Circular)	Circular (from above) mounded unit
Site Feature : Tepe (Conical)	Specific morphology mounded unit traingular profile i.e. Symetrical steep sides and pointed summit
Site Feature : Tepe (Flat Top)	Mounded unit with tabular flat top (i.e. Table top)
Site Feature : Tepe (Low)	Low mounded unit generally less than 5m in height
Site Feature : Tepe (Ovoid)	Mounded elongated circular/sub-circular unit
Site Feature : Tepe (Rectilinear)	(Sub) Square/Rectangular mounded unit
Site Feature : Tepe (Shallow-Sided)	Mounded unit with low gradient profile
Site Feature : Tepe (Shouldered)	Mounded unit with flattened mid/upper slopes and raised summit
Site Feature : Tepe (Slopes)	Slopes of tepe (tappeh)
Site Feature : Tepe (Steep-Sided)	Mounded unit with high gradient profile
Site Feature : Tepe (Summit)	Summit/Upper slopes of tepe (tappeh)
Site Feature : Tepe or Mounded Structure	Mounded unit (generic) NB. All sites with a Site Feature : Tepe (*) should also have a Tepe or Mounded Structure record
Site Feature : Terracing	Land modification to produce multiple stepped flattened areas
Site Feature : Tomb (Unclassified)	Burial structure (unknown style) associated with a site
Site Feature : Unclassified	Feature of archaeological significance recorded at site however form is unclear/unknown
Site Feature : Well	Shaft from surface to water source associated with a site
Site Morphology : Circular	Circular shaped spatial unit
Site Morphology : Dimensions	Height, Width, Length, Area - see Data Comments for specific attributes
Site Morphology : Flat (Site Morphology)	Non-mounded
Site Morphology : Height < 5m	Height < 5m
Site Morphology : Height > 25m	Height > 25m
Site Morphology : Height 10 -15m	Height 10 -15m
Site Morphology : Height 15-20m	Height 15-20m
Site Morphology : Height 20-25m	Height 20-25m
Site Morphology : Height 5-10m	Height 5-10m

UNIQUE DATA TYPE	GLOSSARY
Site Morphology : Irregular	Irregular shaped spatial unit (i.e. Not recognisable polygon)
Site Morphology : Low Rise	Slight area of mounding associated with spatial unit, may or may not be archaeological. Often associated with soil colour difference
Site Morphology : Ovoid	Elongated circular/sub-circular shaped unit
Site Morphology : Rectangular	Rectangular shaped spatial unit
Site Morphology : Rectilinear	(Sub)Square or rectangular spatial unit
Site Morphology : Square	(Sub)Square spatial unit
Site Morphology: Cluster	Cluster of circular spatial units
Survey Methodology : Desk Based Assessment	Analysis of spatial unit from non-field location e.g. Satellite imagery interpretation, literature etc
Survey Methodology : Driving Visit	Spatial unit briefly attended and noted but not thoroughly investigated
Survey Methodology : Evidence Collected	Artefact(s) removed from spatial unit
Survey Methodology : Evidence Quantified	Artefact(s) counted on or off-spatial unit
Survey Methodology : Field Collection Attempted	Artefact pick-up carried out, no material discovered
Survey Methodology : Field Visit	Spatial unit attended and field analysis carried out
Survey Methodology : Geomorphological Survey	Field assessment/recording of geomorphological features at spatial unit
Survey Methodology : GPS Mapping (Features)	Features within spatial unit mapped using a GPS e.g. Cairns
Survey Methodology : GPS Mapping (Site Extent and Features)	Overall spatial extent of and features within spatial unit mapped using a GPS
Survey Methodology : GPS Mapping (Site Extent)	Overall spatial extent of spatial unit mapped using a GPS
Survey Methodology : Ground Truth of Imagery	Spatial unit identified from imagery source and verified in the field
Survey Methodology : No GPS Survey	GPS not used in field visit
Survey Methodology : No Site Visit	Spatial unit not visited
Survey Methodology : Non-Transect	Spatial unit is not a transect (summary record)
Survey Methodology : Pickup (10m x 10m)	Artefacts collected by dimensions and sample method (specified)
Survey Methodology : Pickup (2m diameter; non-sieved)	Artefacts collected by dimensions and sample method (specified)
Survey Methodology : Pickup (2m diameter; sieved)	Artefacts collected by dimensions and sample method (specified)
Survey Methodology : Pickup (2m x 2m x 0.2m sieve)	Artefacts collected by dimensions and sample method (specified)
Survey Methodology : Pickup (4m x 1m x 0.2m sieve)	Artefacts collected by dimensions and sample method (specified)
Survey Methodology : Pickup (Shovel)	Artefacts collected by dimensions and sample method (specified)
Survey Methodology : Pickup (Surface Extent)	Artefacts collected by dimensions and sample method (specified)

UNIQUE DATA TYPE	GLOSSARY
Survey Methodology : Pickup (Systematic non-sieved)	Artefacts collected by dimensions and sample method (specified). N.B. Systematic includes any kind of specifically defined/quantifiable sub-divisions
Survey Methodology : Pickup (Transect)	Spatial unit walked in lines, number of individuals and spacing recorded
Survey Methodology : Pickup (Unspecified)	Artefacts collected, collection unit not recorded
Survey Methodology : Planning (Total Station)	Mapping of spatial unit carried out by total station survey
Survey Methodology : Sounding	Small-scale trench/sondage excavated
Survey Methodology : Spatial Unit Description	Written description of spatial unit
Survey Methodology : Specialist Evidence Collected	Diagnostic artefacts collected from spatial unit
Survey Methodology : Specialist Evidence Quantified	Diagnostic artefacts quantified

Table D. Period codes used in the database.

PERIOD_CODE_TEXT	NAME
PAL	Palaeolithic
EPAL	Epipalaeolithic
ACN	Aceramic Neolithic
NEO	Neolithic
ENEO	Early Neolithic
LNEO	Late Neolithic
PRE_KIA	Prehistoric (Kiani)
PRE	Prehistoric
CH	Chalcolithic
ECHAL	Early Chalcolithic
MCHAL	Mid Chalcolithic
LCHAL	Late Chalcolithic
FRM	Forth Millennium
EBA	Early Bronze Age
BA	Bronze Age
TM	Third Millennium
SM	Second Millennium
MBA	Middle Bronze Age
LBA	Late Bronze Age
IA1	Iron I
IA	Iron Age
IA_KIA	Iron Age (Kiani)
IA2	Iron II

PERIOD_CODE_TEXT	NAME
FM	First Millennium
IA3	Iron III
ACH	Achaemenid
ACH_KIA	Achaemenid (Kiani)
IA4	Iron IV
IA34	Iron III/IV
ACH_PAR	Achaemenid/Early Parthian
SEL	Seleucid
SEL_PAR	Seleuco-Parthian
MEDE	Median
PAR_KIA	Parthian (Kiani)
PAR	Parthian
EPAR	Early Parthian
MPAR	Middle Parthian
TPAR	Terminal Parthian
PAR_SAS	Parthian-Sasanian
LA	Late Antique
SAS_KIA	Sasanian (Kiani)
SAS	Sasanian
ESAS	Early Sasanian
MSAS	Middle Sasanian
LSAS	Late Sasanian
SAS_EISL	Sasanian-Early Islamic
ISL	Islamic
EISL	Early Islamic
EISL_K	Early Islamic - Kiani
MISL	Middle Islamic
LISL	Late Islamic
UMM	Ummayyad
SELJ	Seljuq
KH_SH	Khwarazm-Shadid
ILK	Ilkhanid
MED	Medieval
TIM_SAF	Timurid-Safavid
TIM	Timurid
SAF	Safavid
17C	17th Century
18C	18th Century
19C	19th Century